

Figure 1

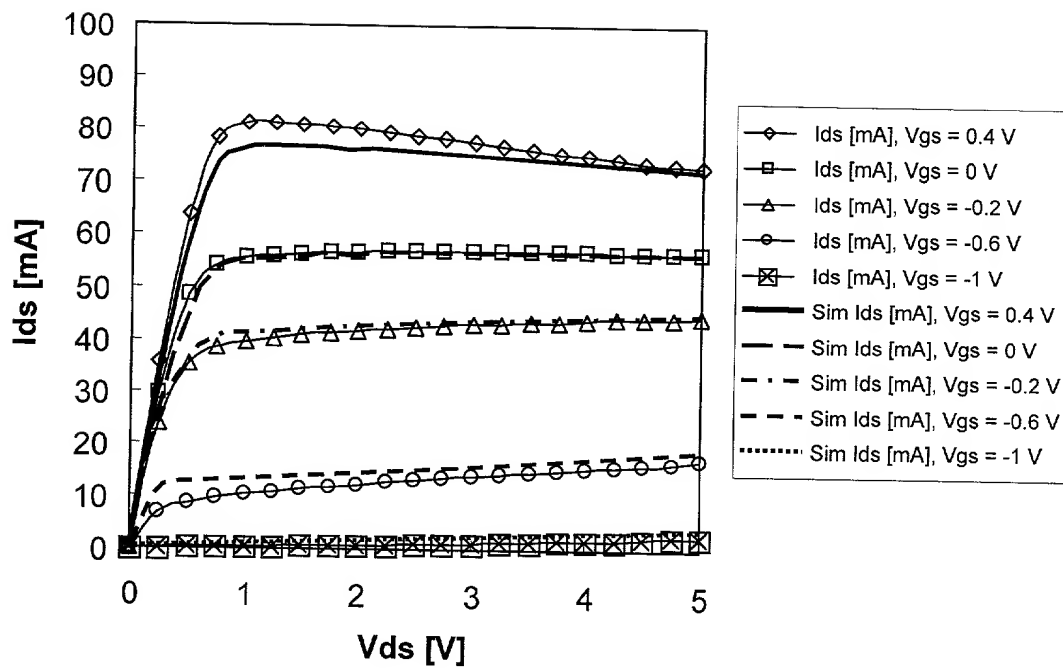


Figure 2

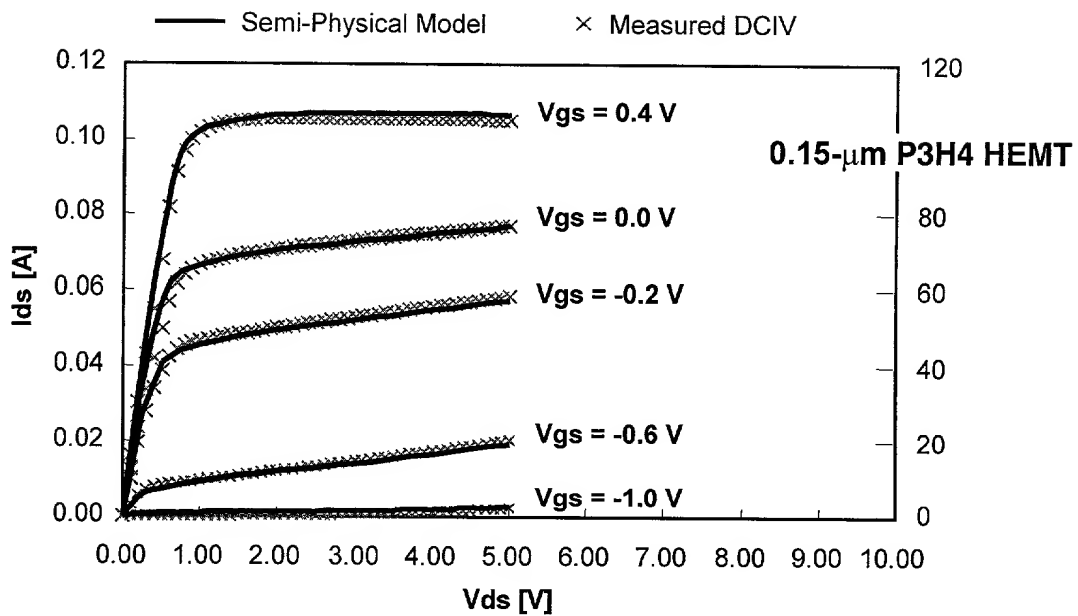


Figure 3

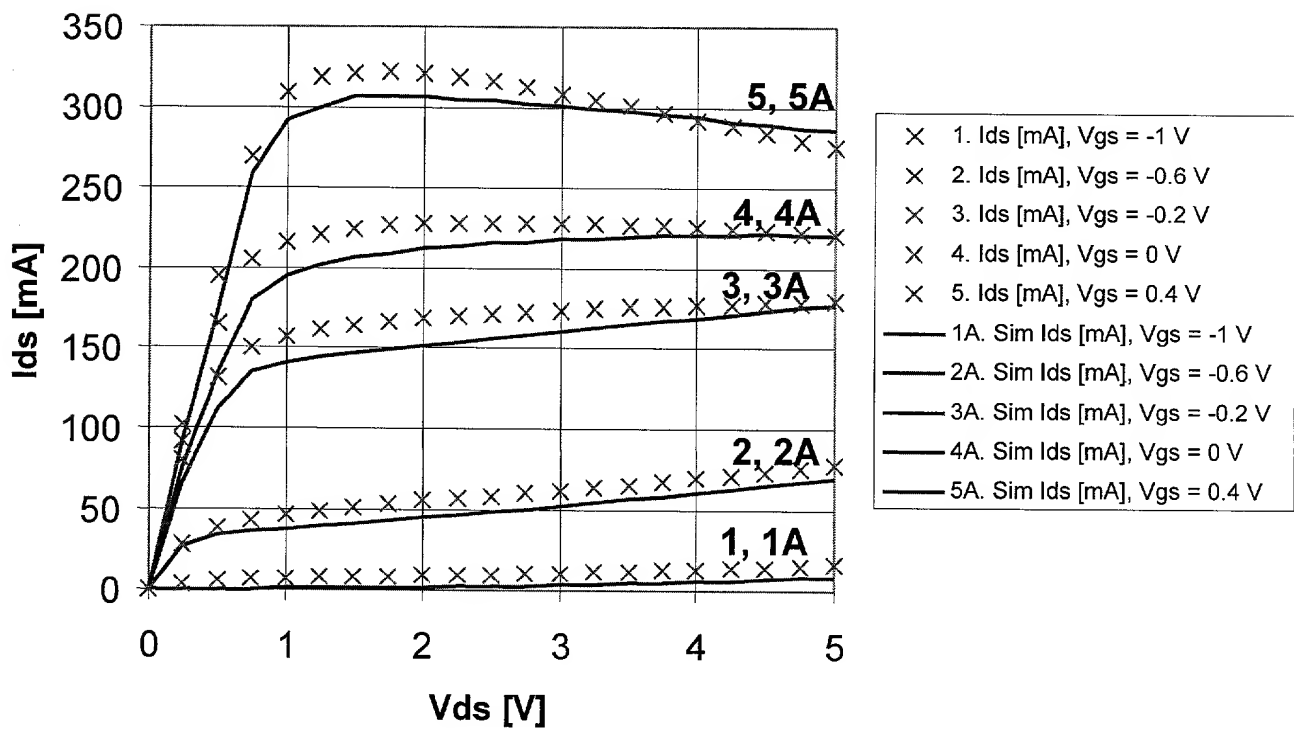


Figure 4

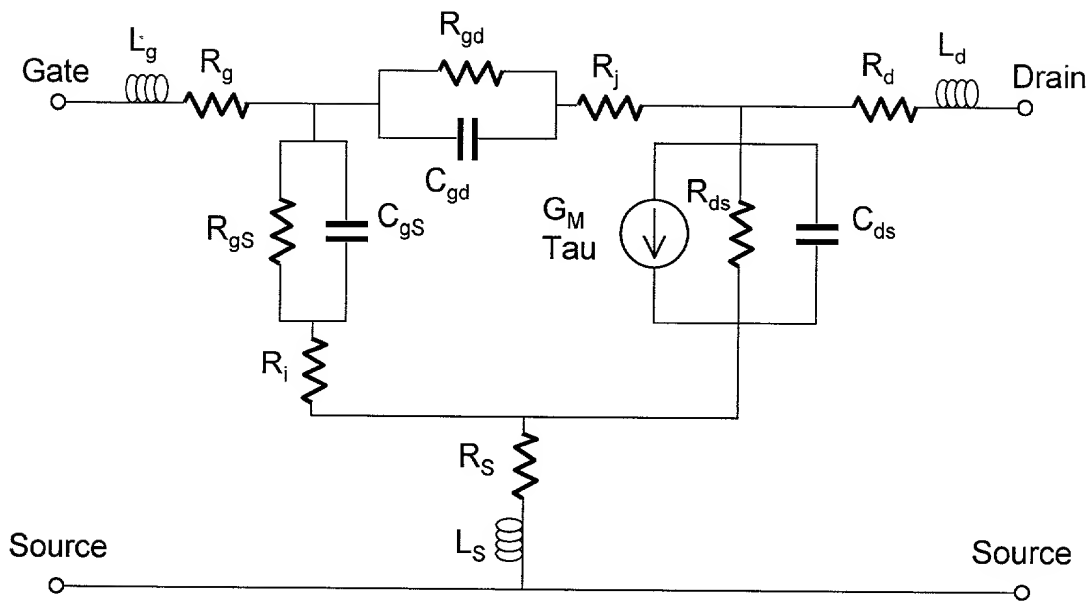


Figure 5

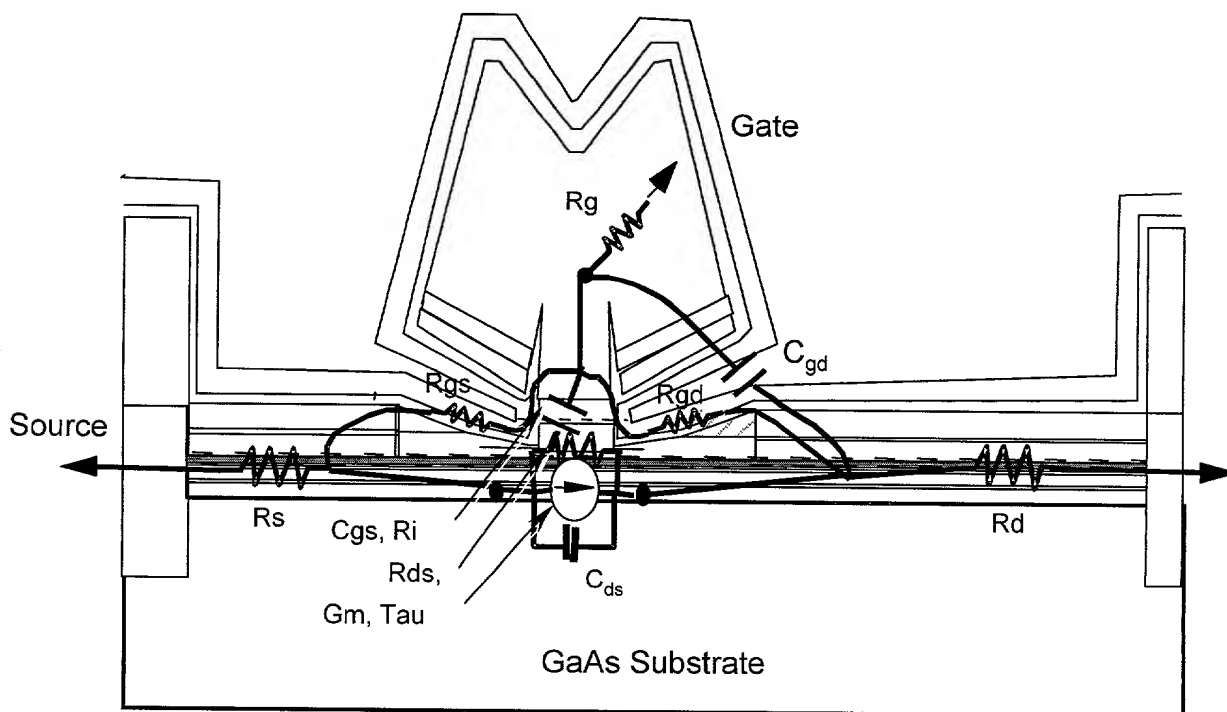


Figure 6

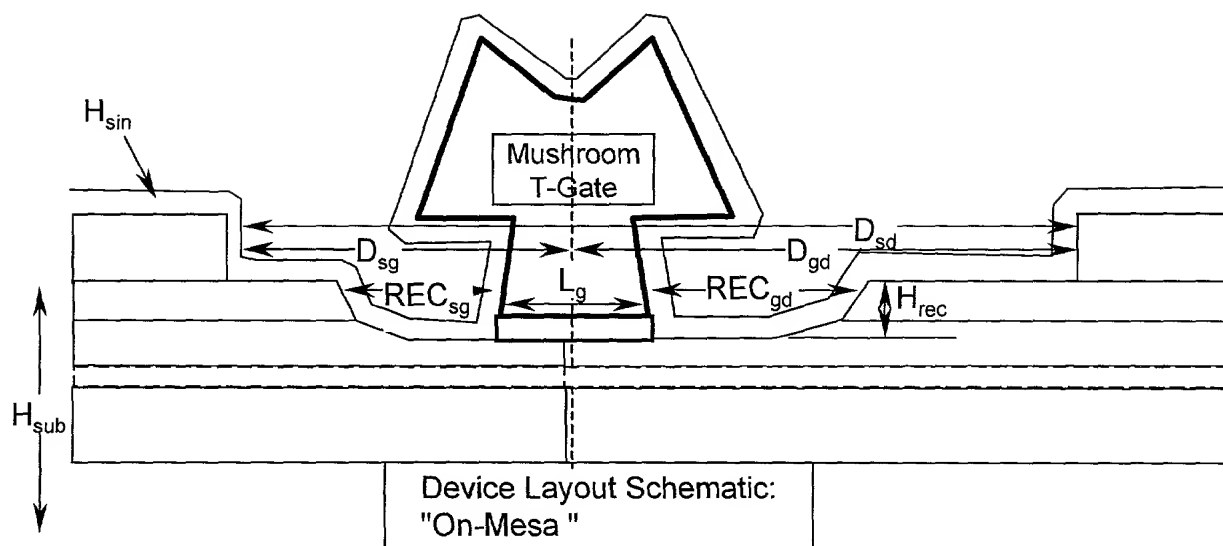


Figure 7

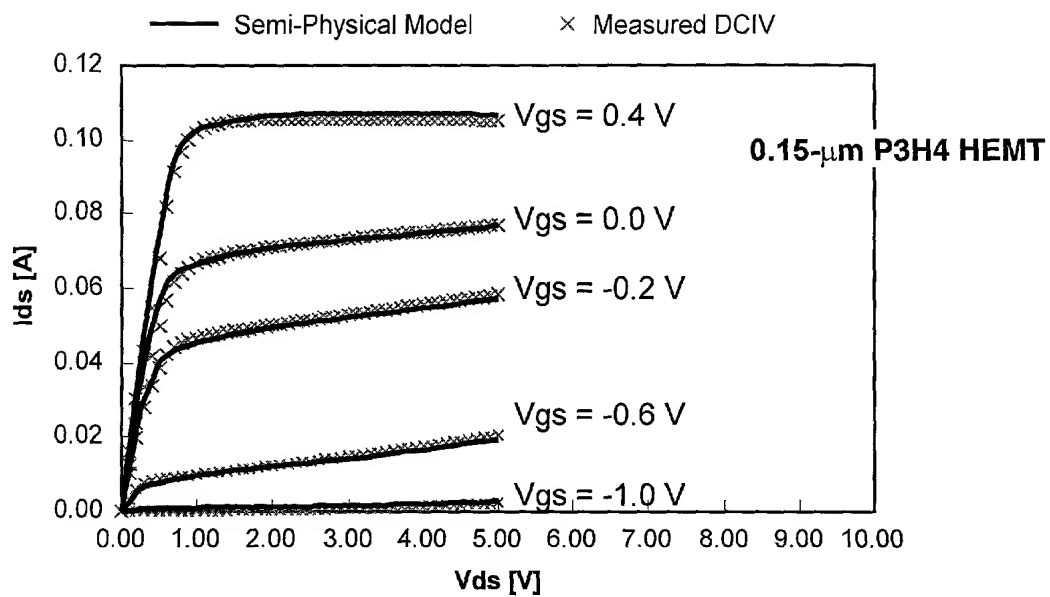


Figure 8

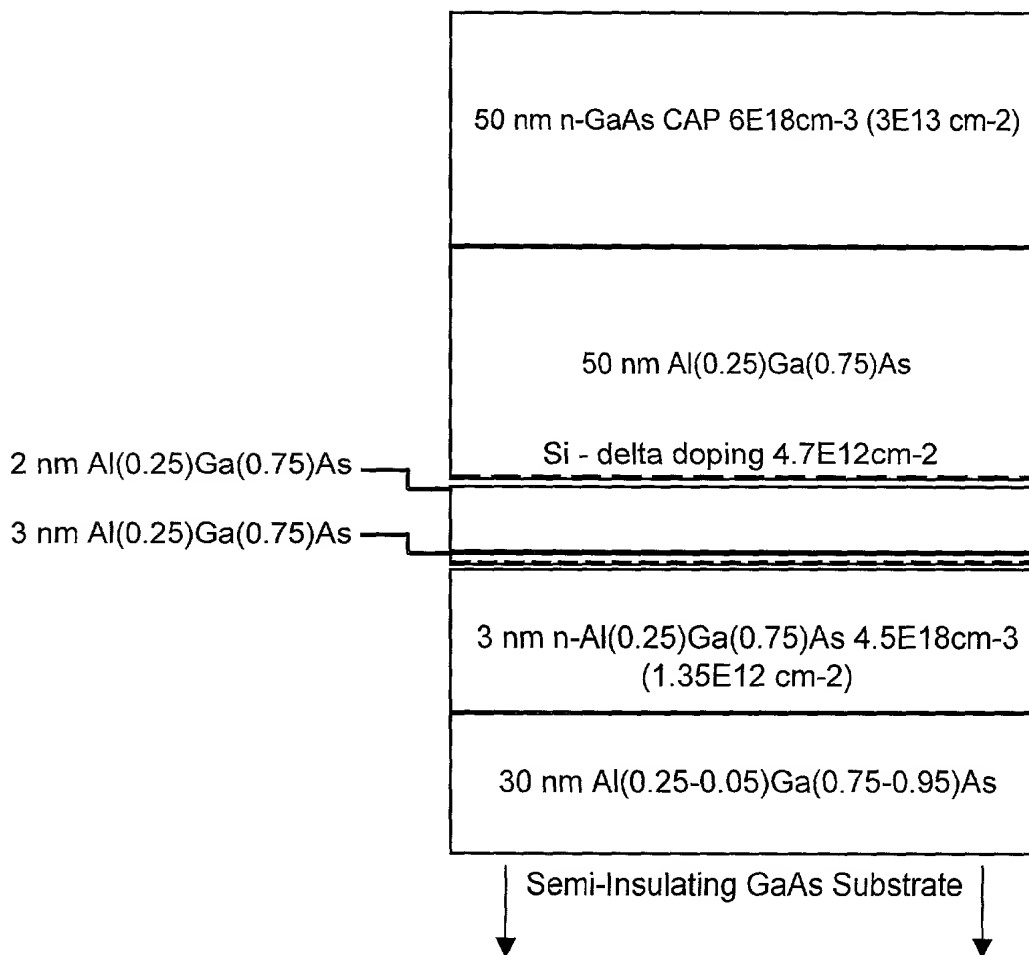


Figure 9

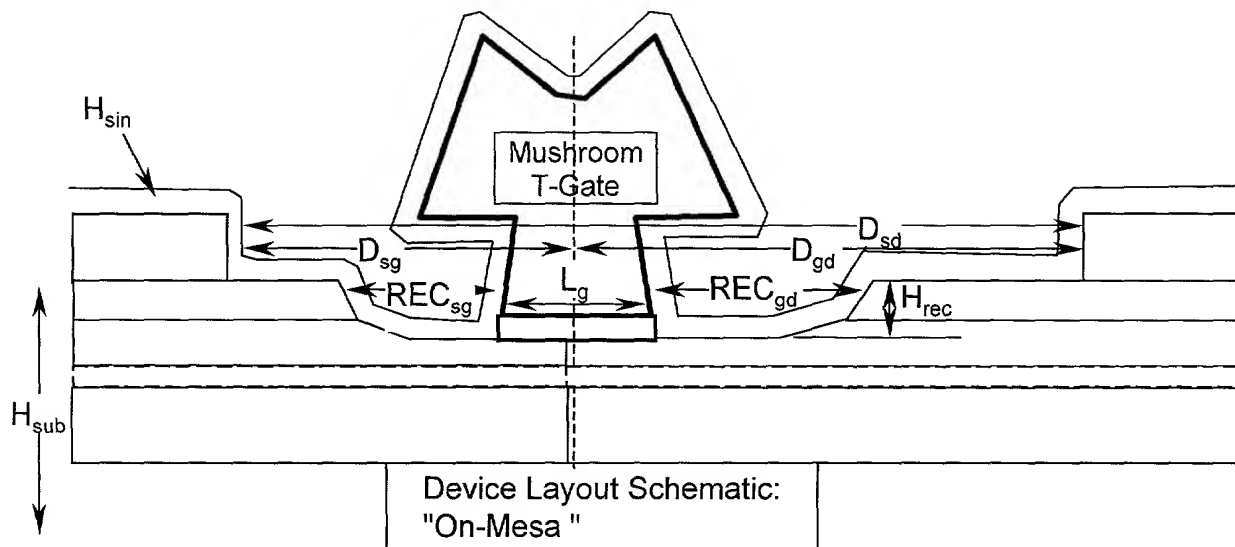


Figure 10

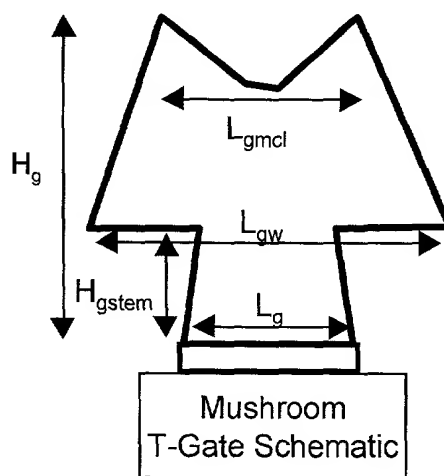


Figure 11

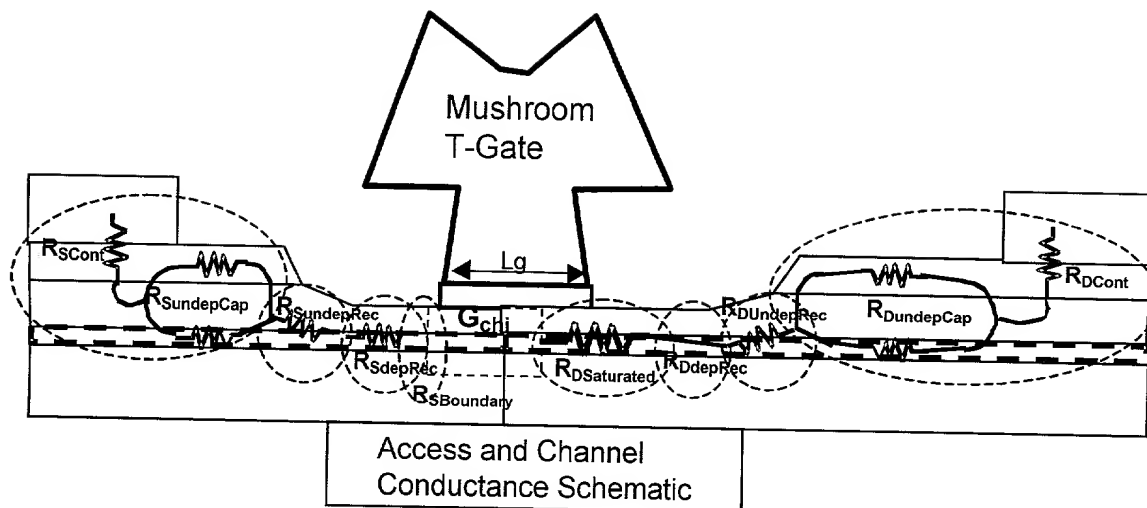
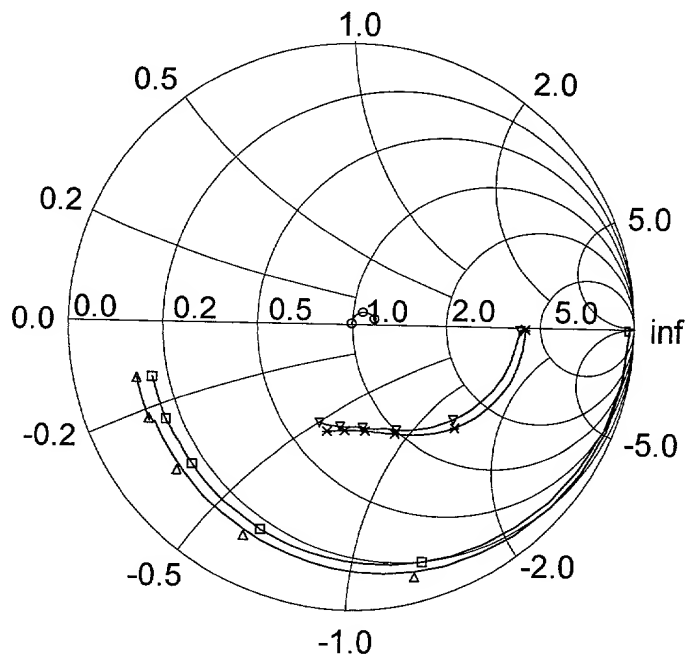
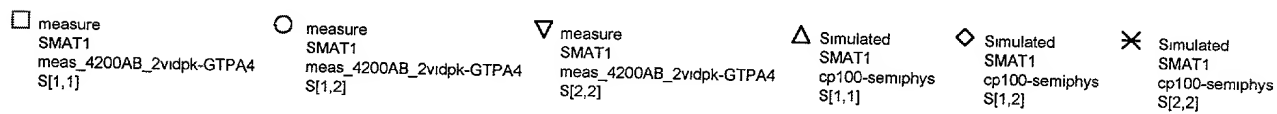


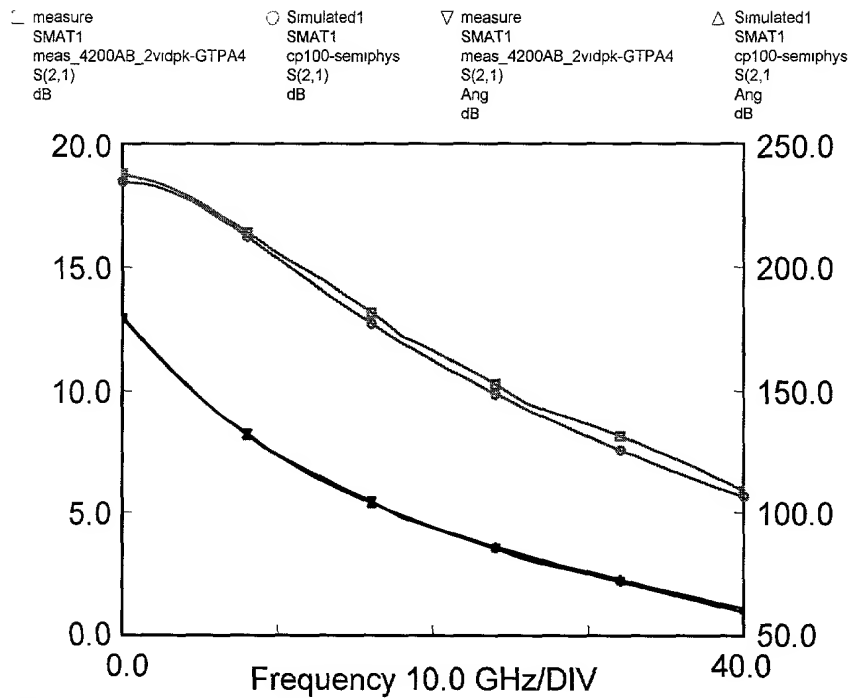
Figure 12



Frequency 0.05 to 40.05 GHz

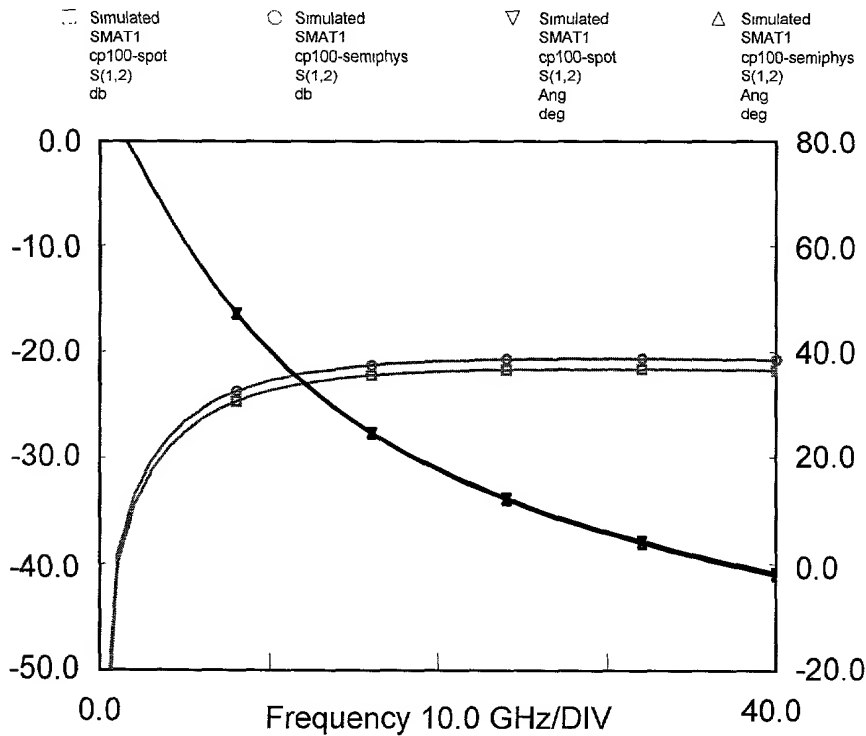
Measured vs Modeled S-parameters  
Simulated Equivalent Circuit Element Values  
via Semi-Physical HEMT Model

Figure 13



Measured vs Modeled S12  
Simulated Equivalent Circuit Element Values via  
Semi-Physical HEMT Model

Figure 14



Measured vs Modeled S12  
Simulated Equivalent Circuit Element Values via  
Semi-Physical HEMT Model

Figure 15



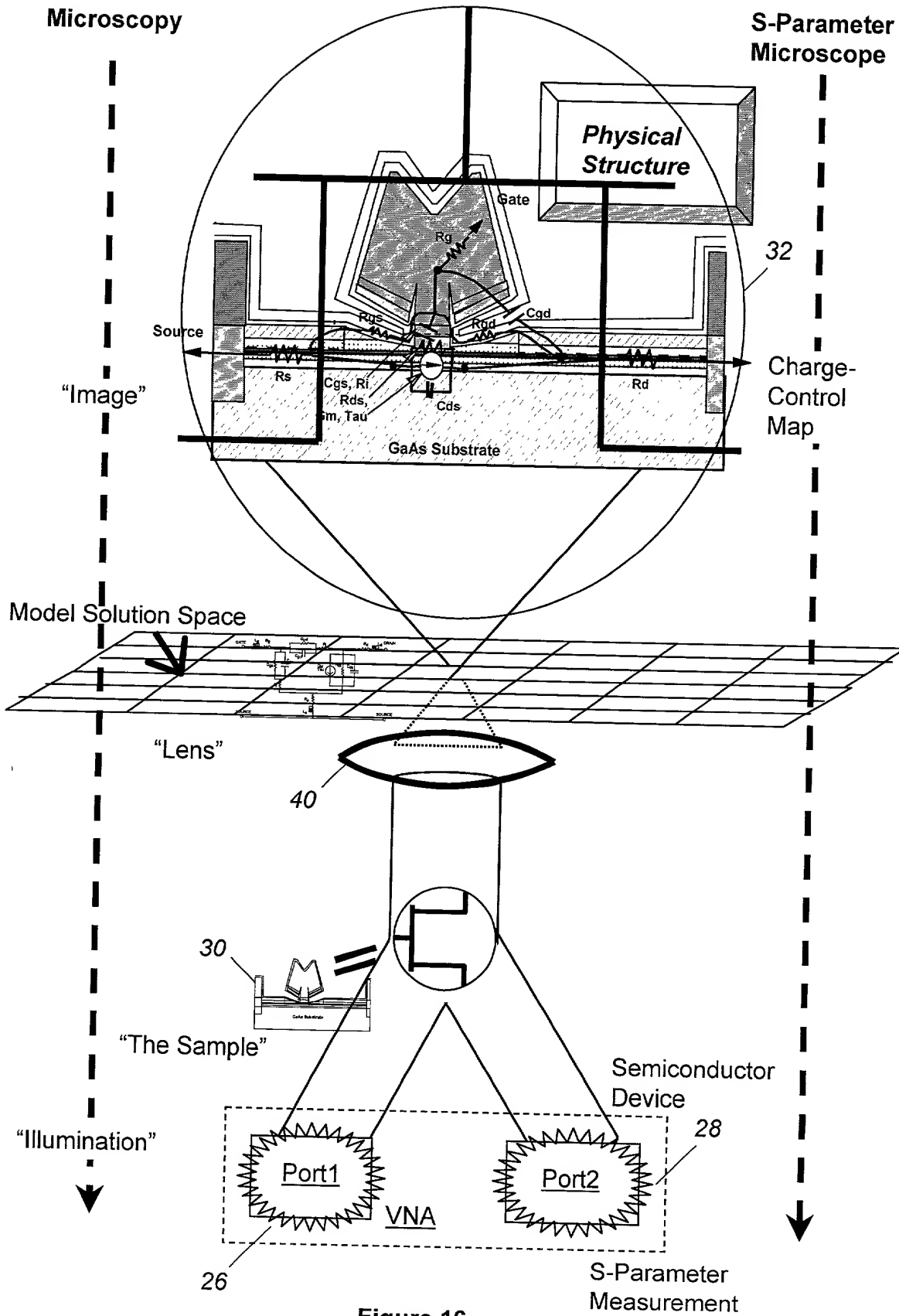


Figure 16

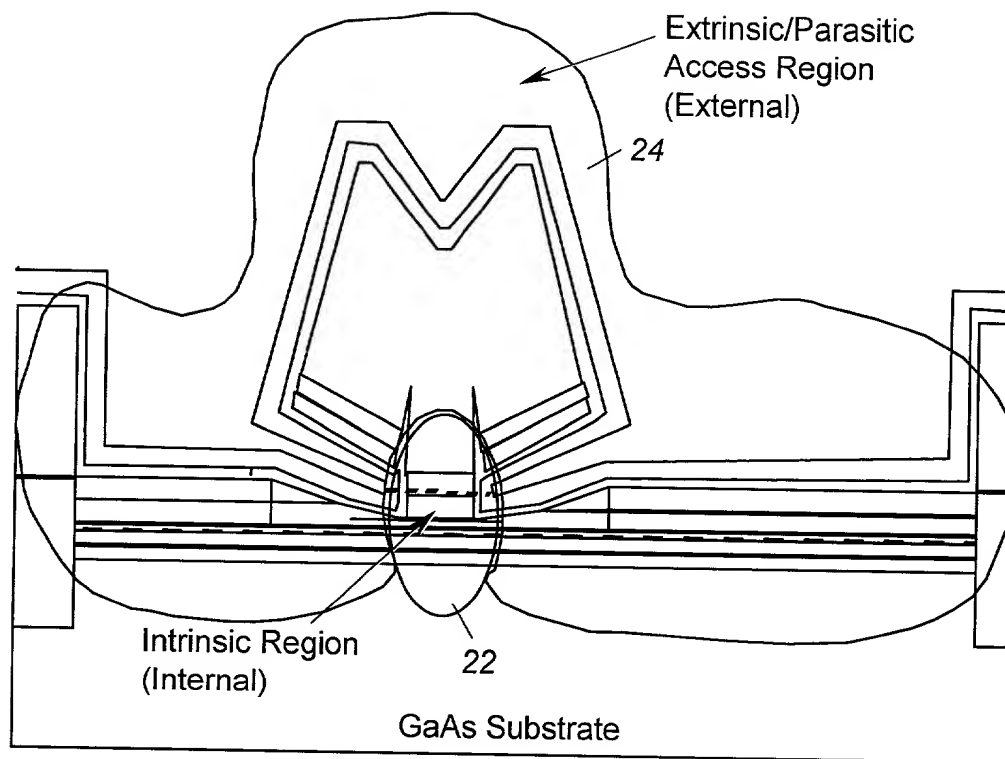


Figure 17

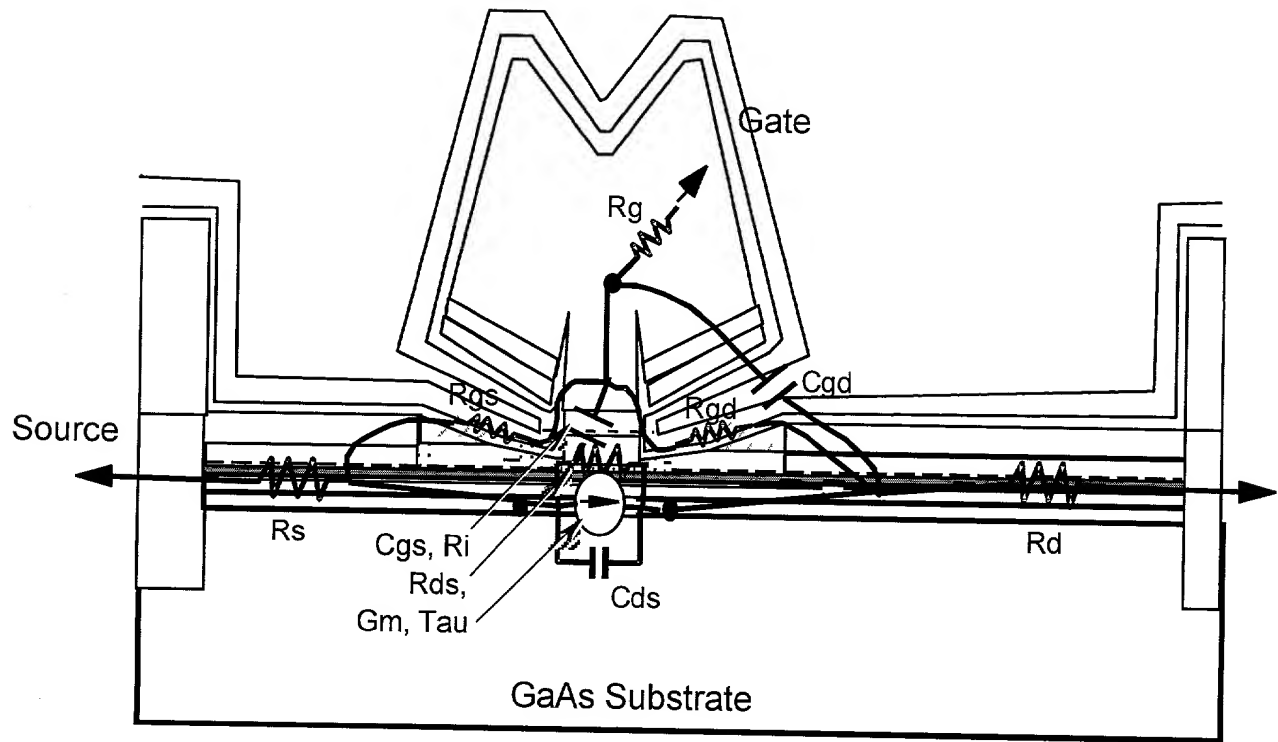


Figure 18

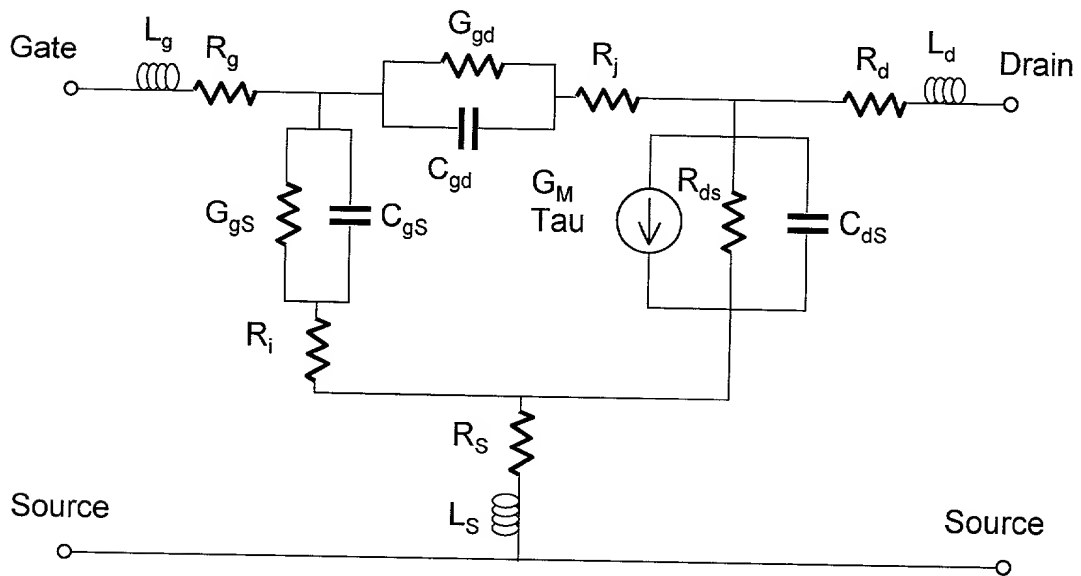
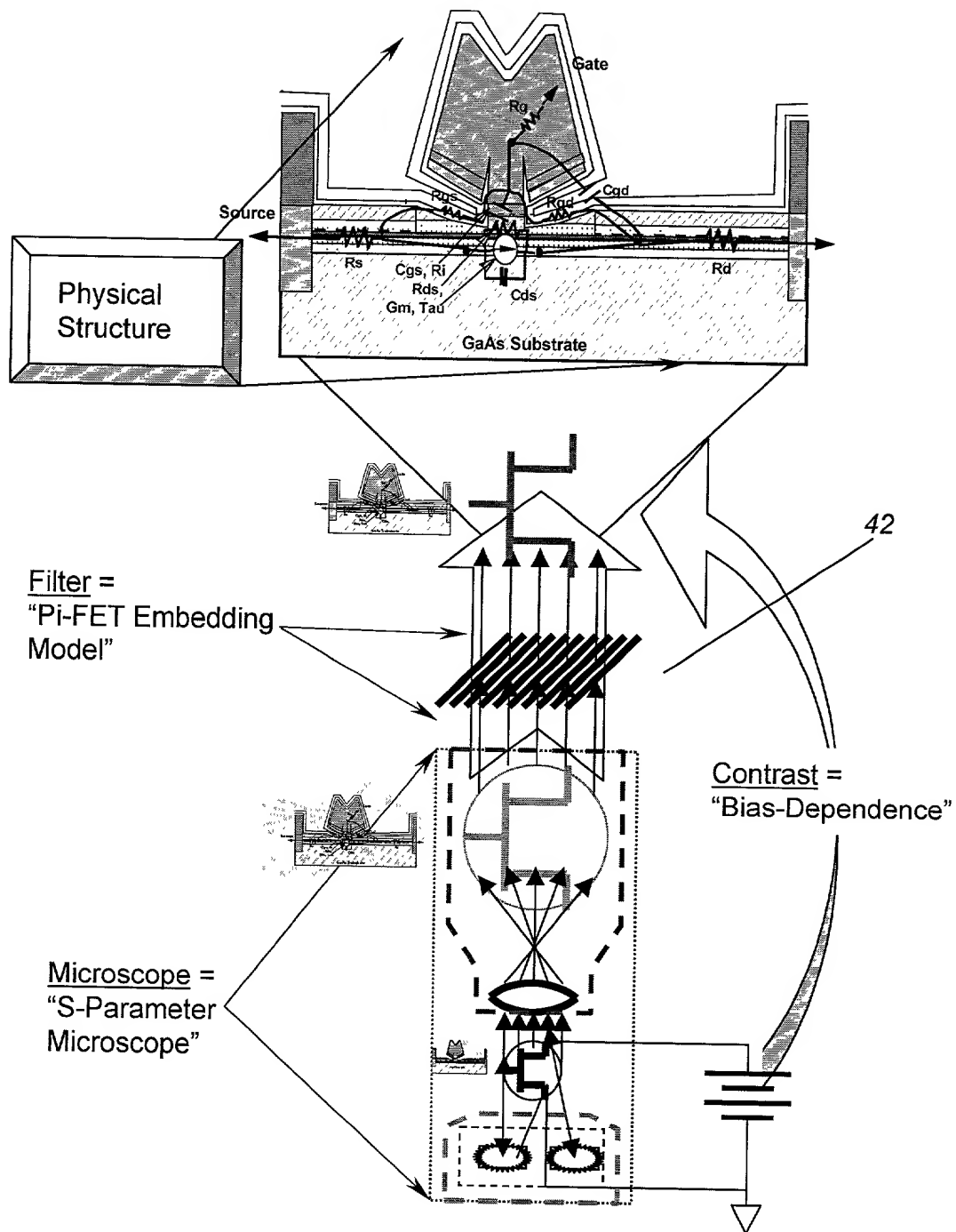


Figure 19



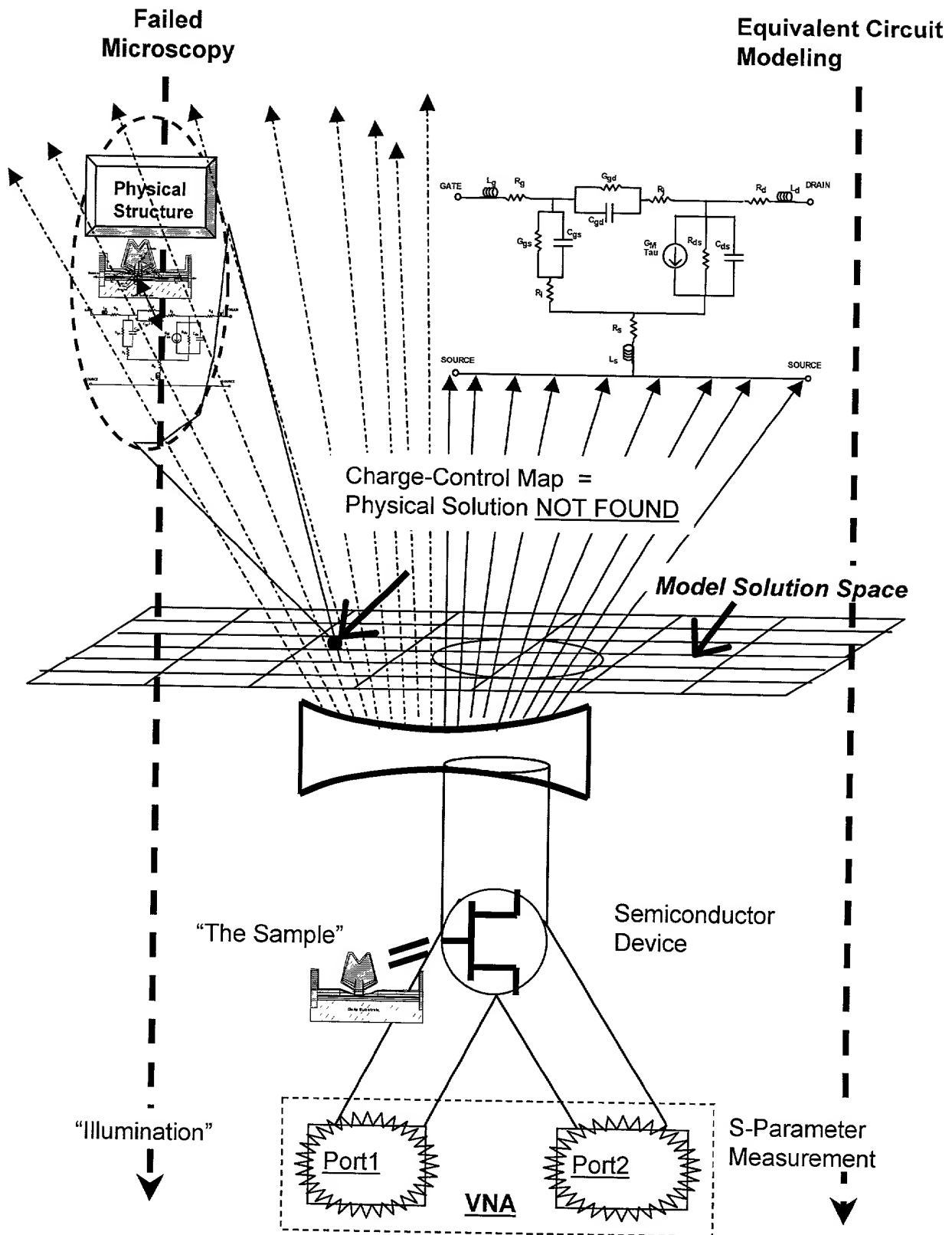


Figure 21

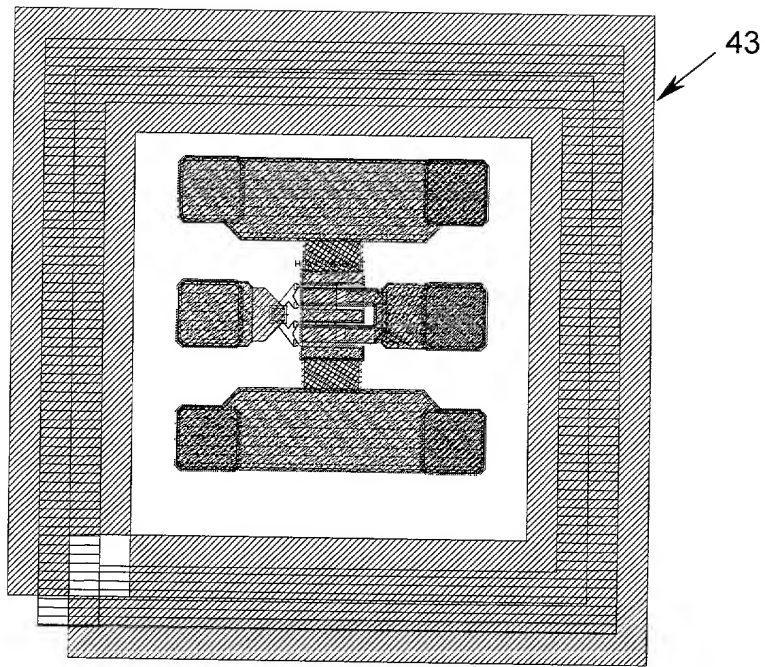


Figure 22

**Ids vs Vds for the Measured HEMT Device**

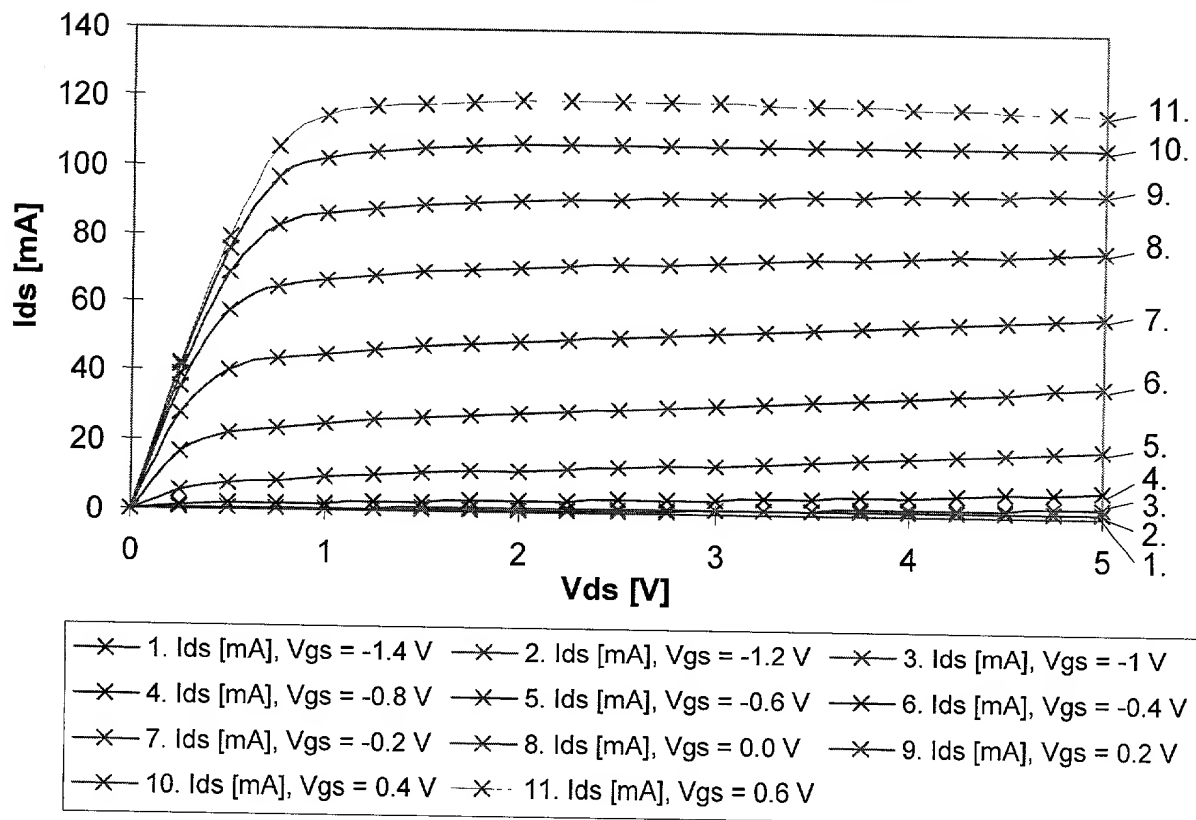
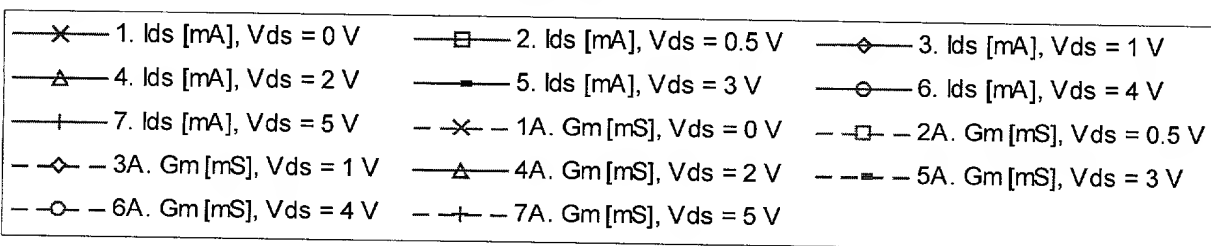
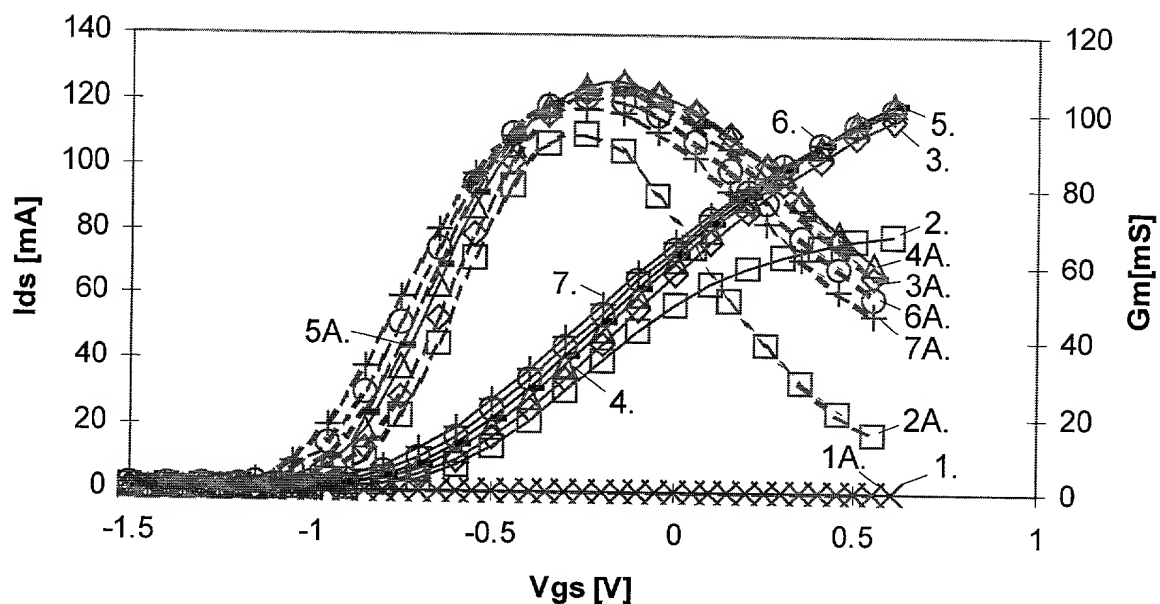
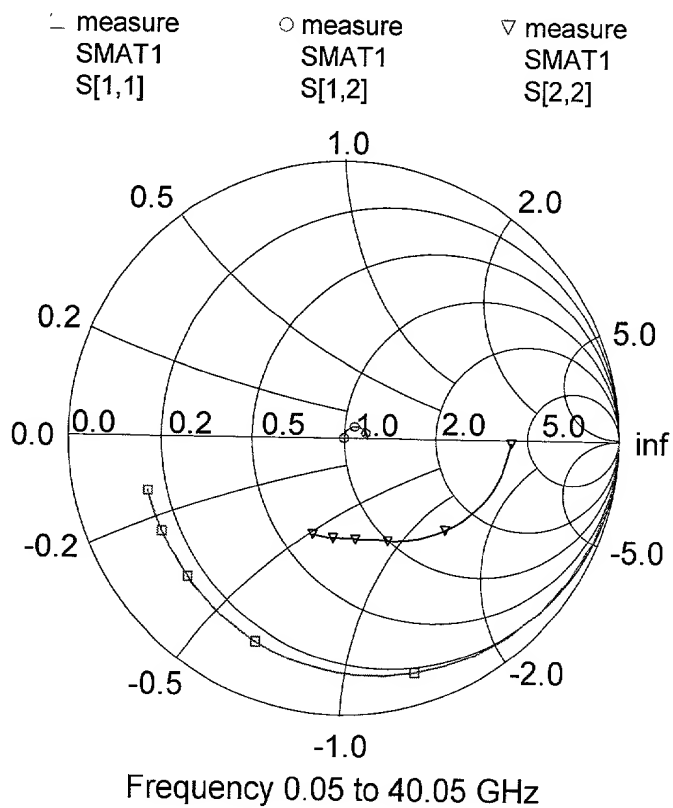


Figure 23

**$I_{ds}$  and  $G_m$  vs  $V_{gs}$  for the Measured Device**



**Figure 24**



**Figure 25**

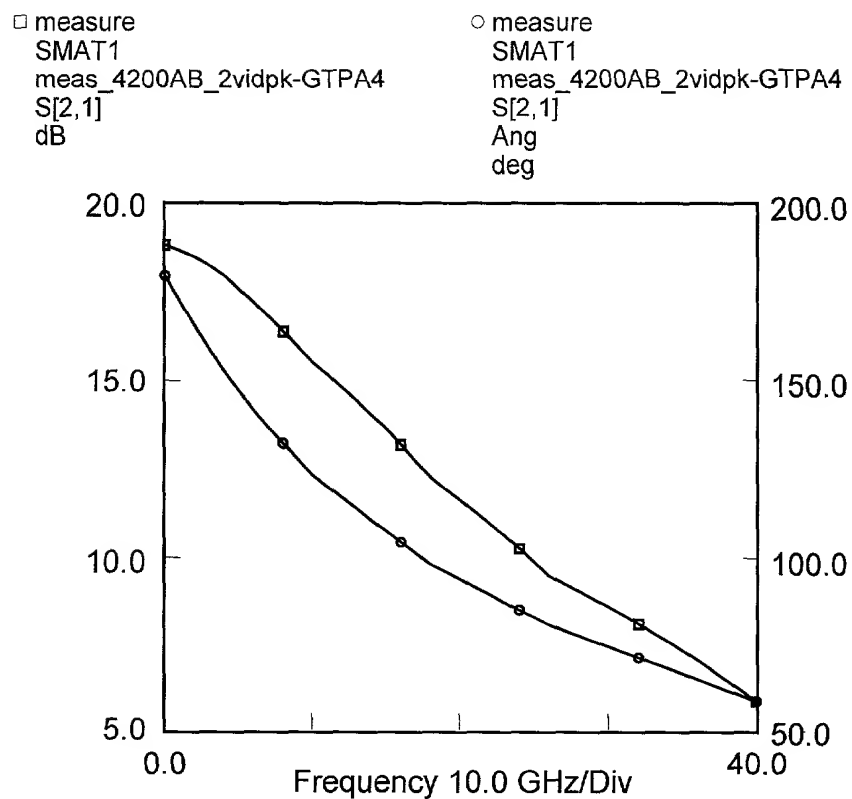


Figure 26

### Intrinsic Device Source Resistance vs Gate Bias

0.15  $\mu\text{m}$  P3H4 HEMT

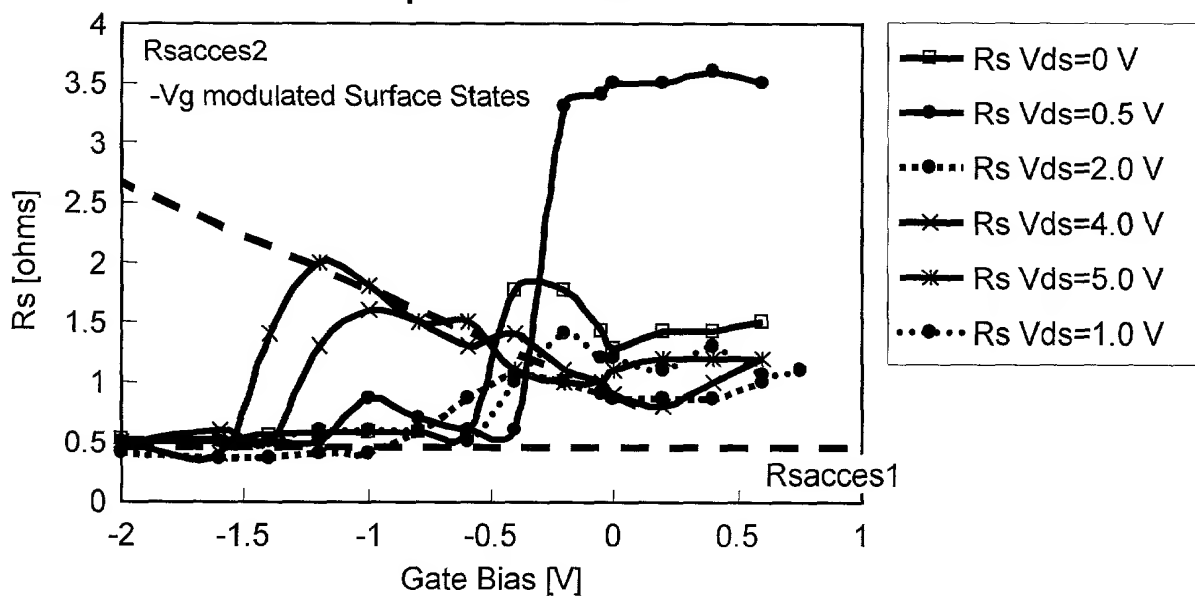


Figure 27



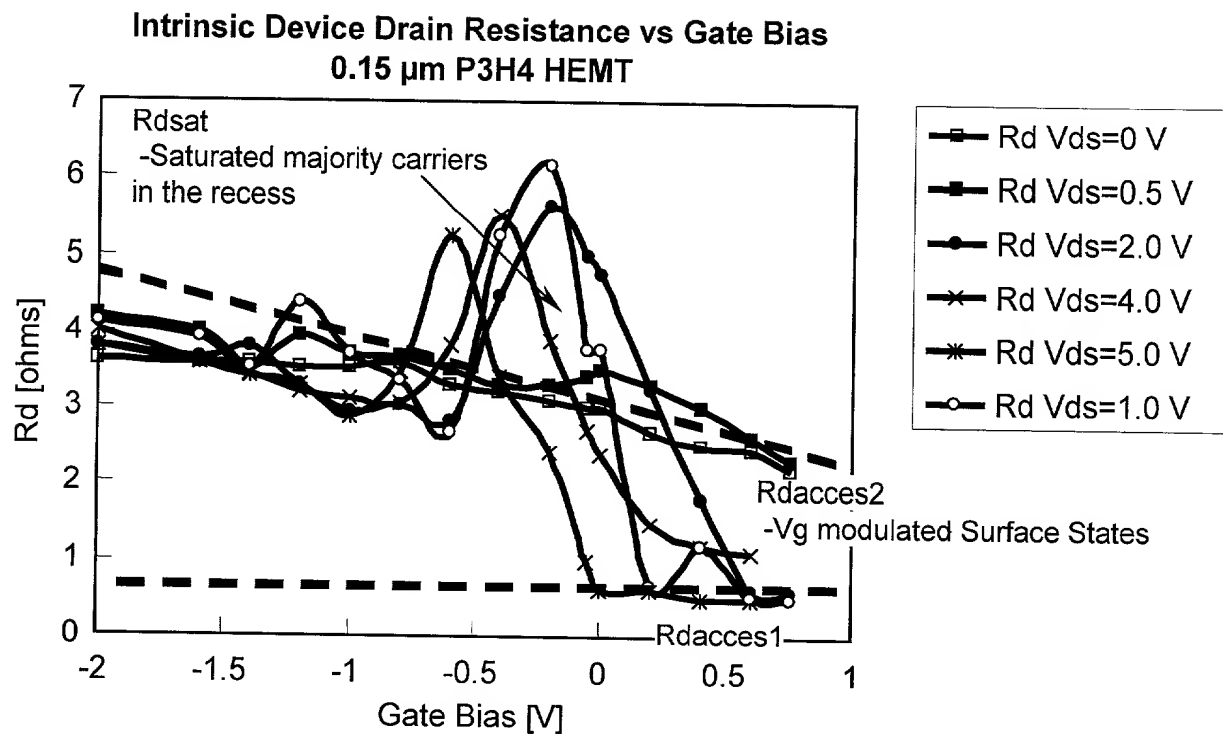


Figure 28

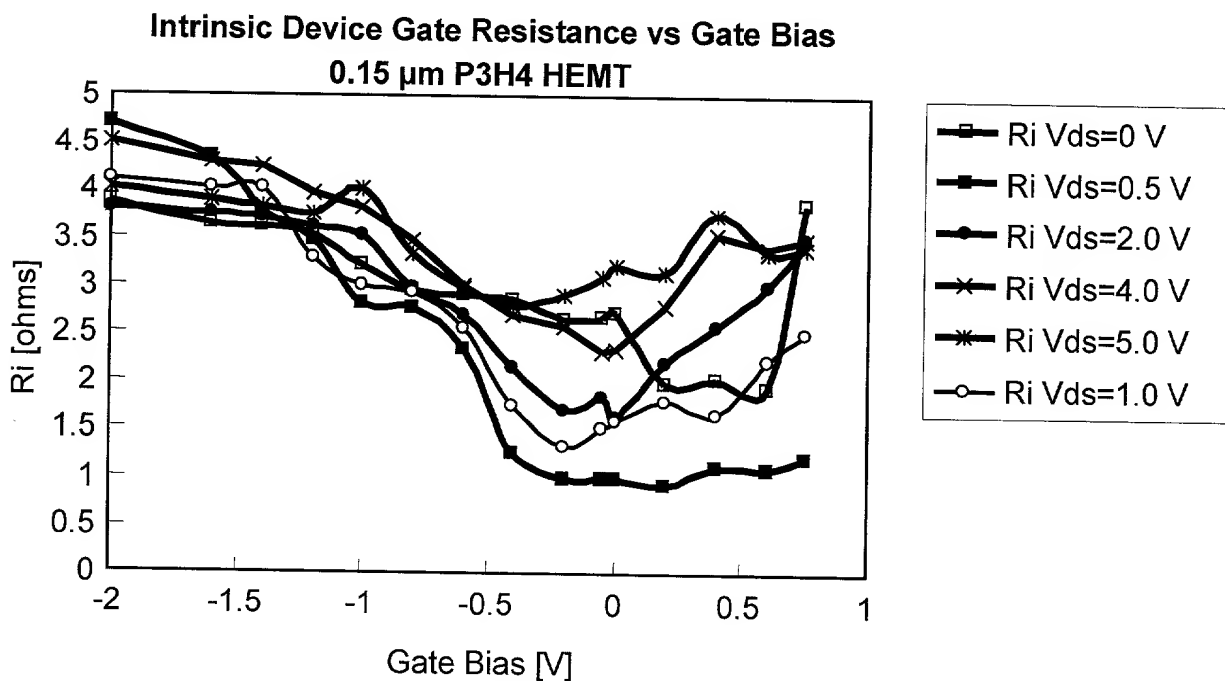
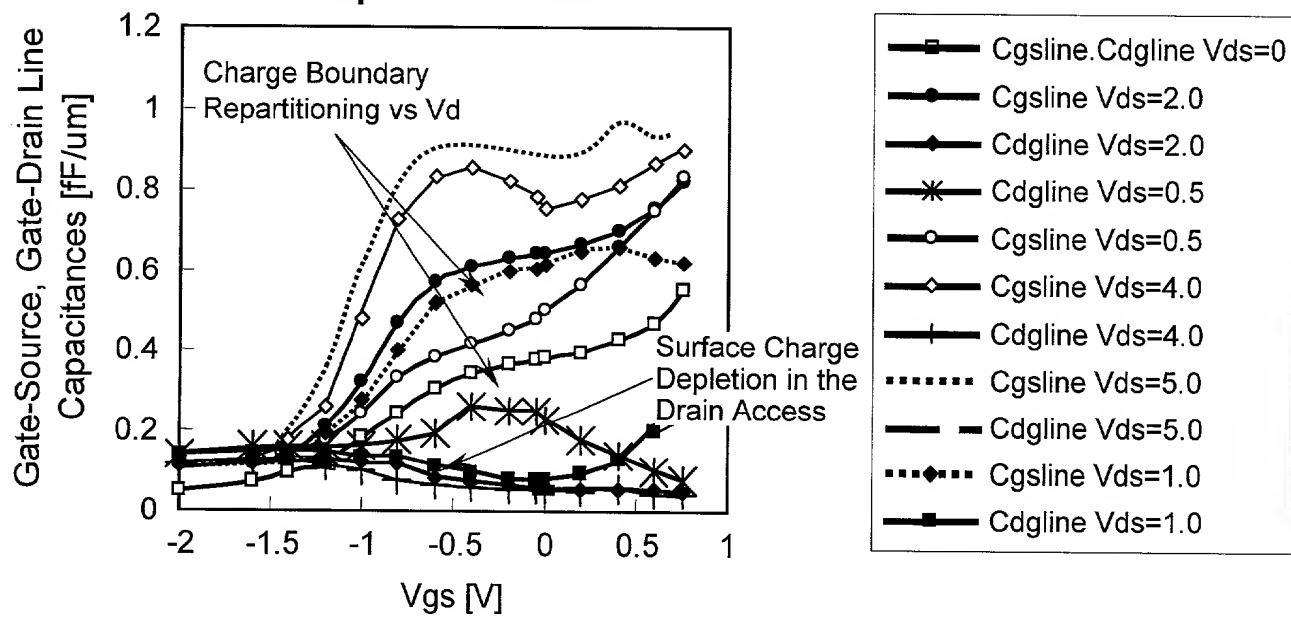


Figure 29

# **Intrinsic Device Line Capacitance vs Gate Bias** **0.15 $\mu$ m P3H4 HEMT**



**Figure 30**

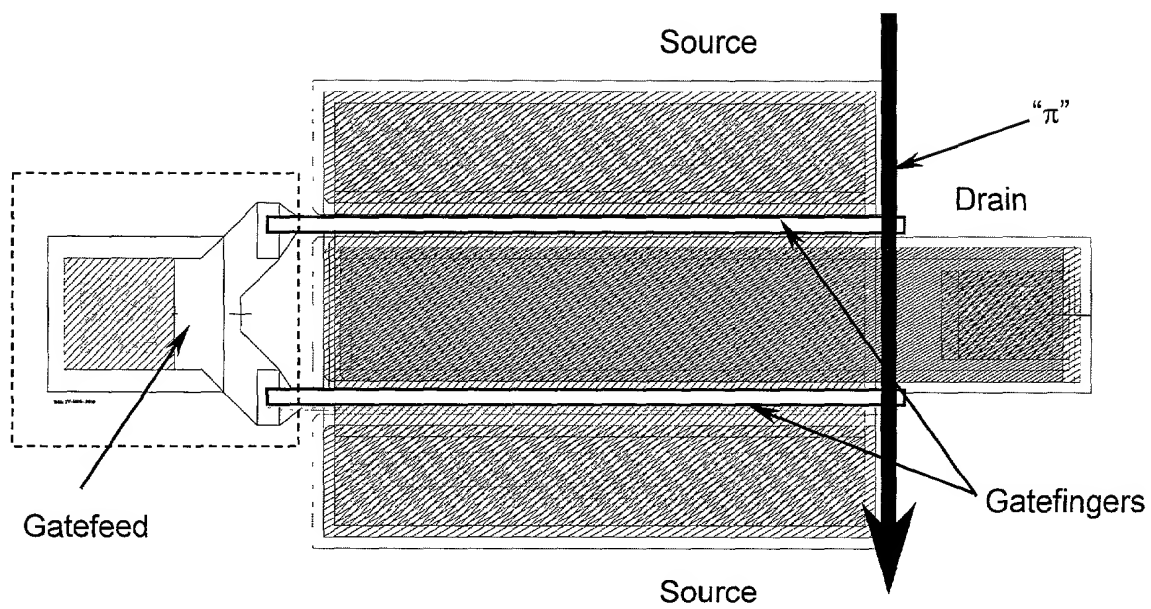
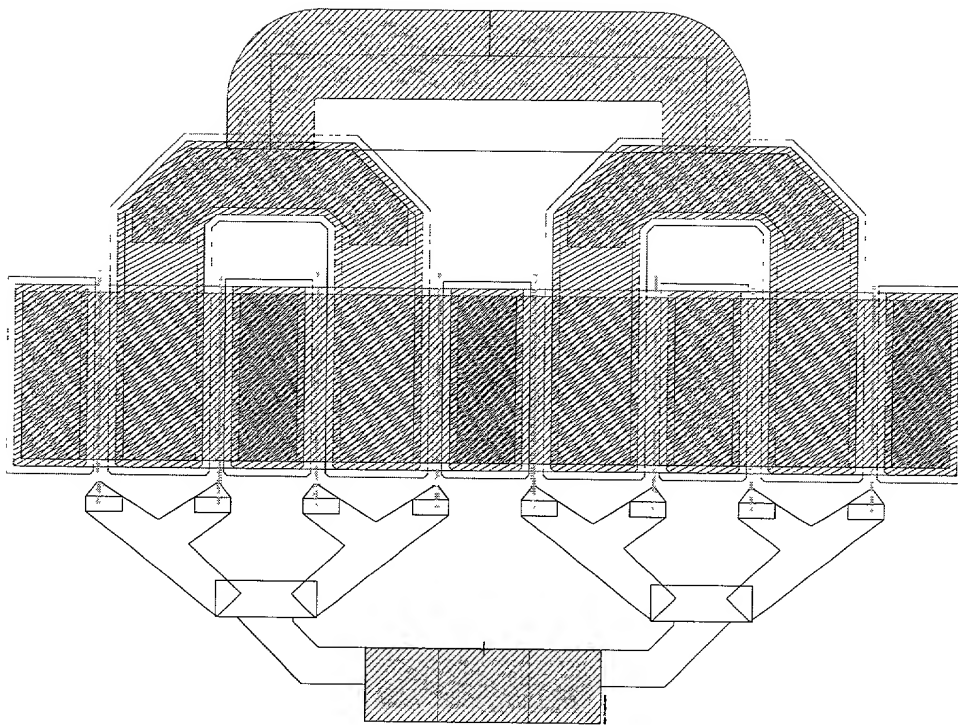


Figure 31



**Figure 32**

**Model Construction**

- 1) Off-Mesa, or Boundary Parasitic Model
- 2) Inter-electrode Parasitic Model
- 3) On-Mesa Parasitic Model
- 4) Intrinsic Model

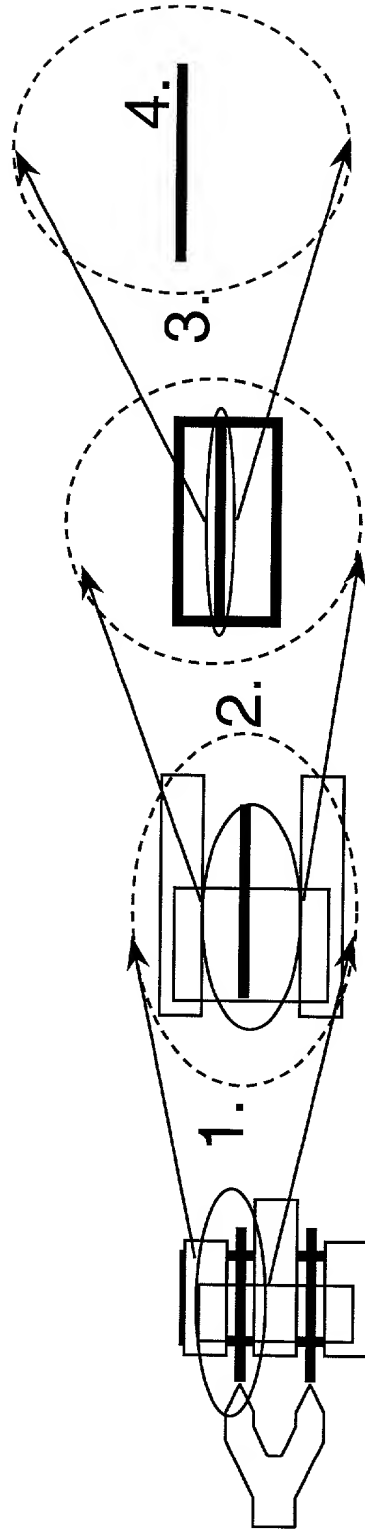


Figure 33

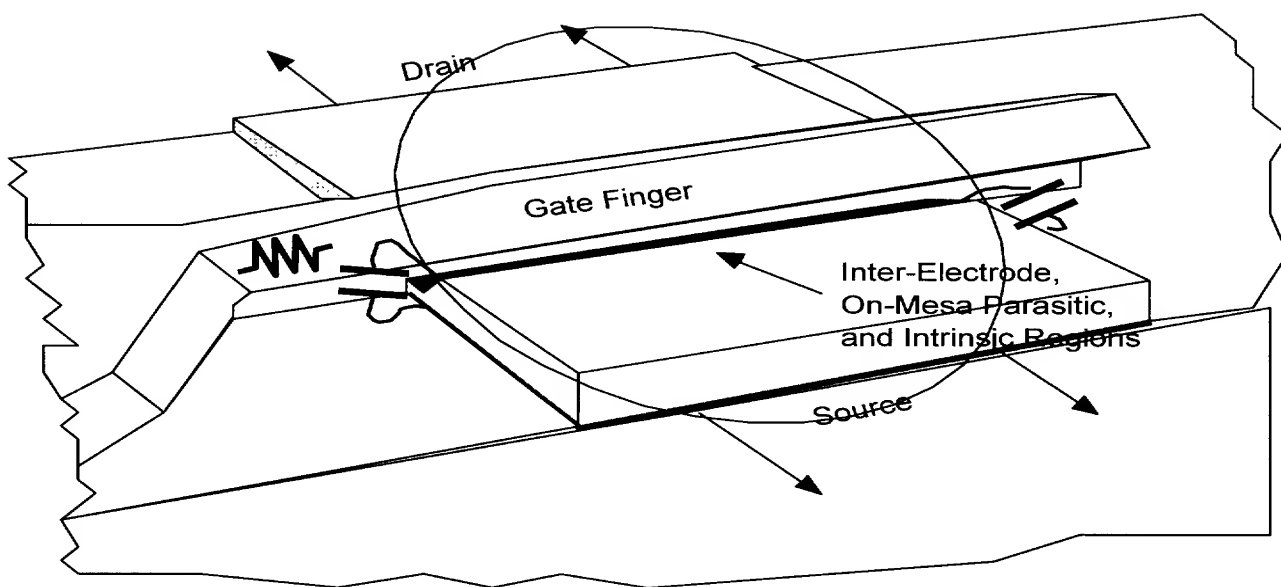


Figure 34

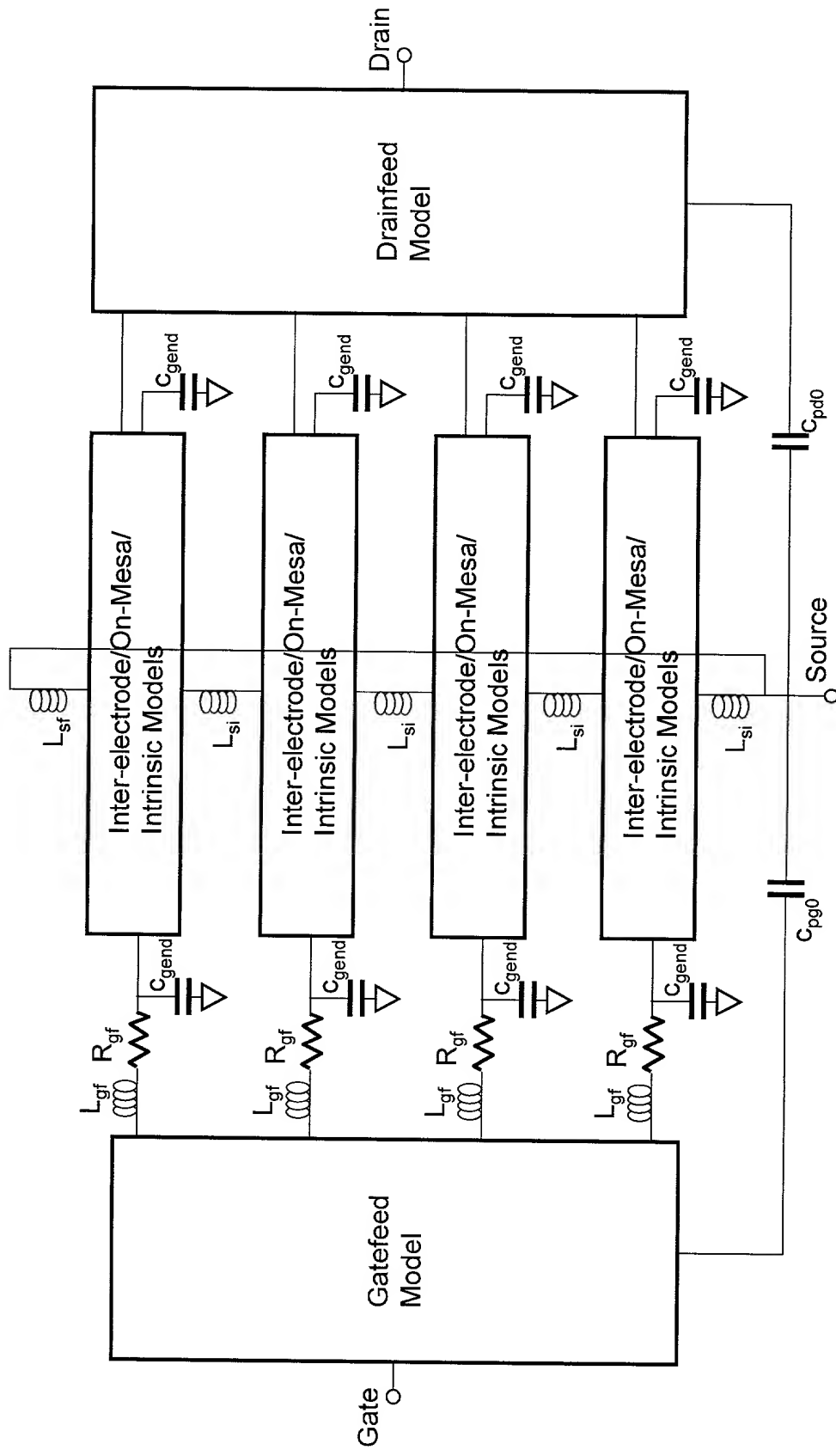


Figure 35

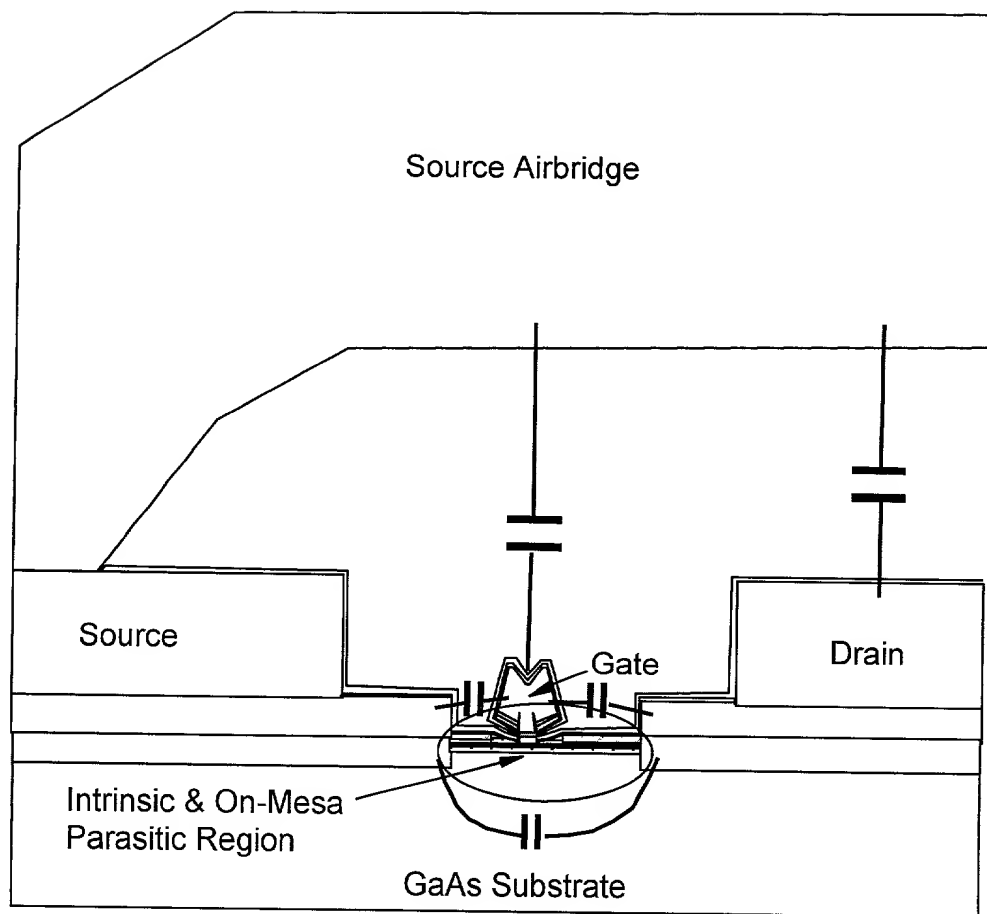
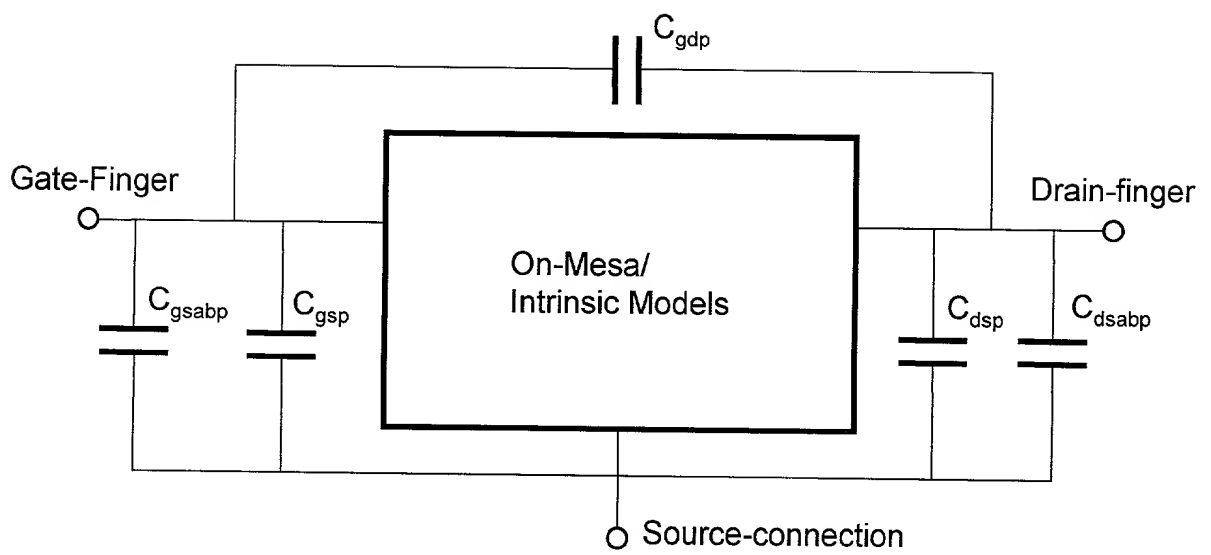


Figure 36





**Figure 37**

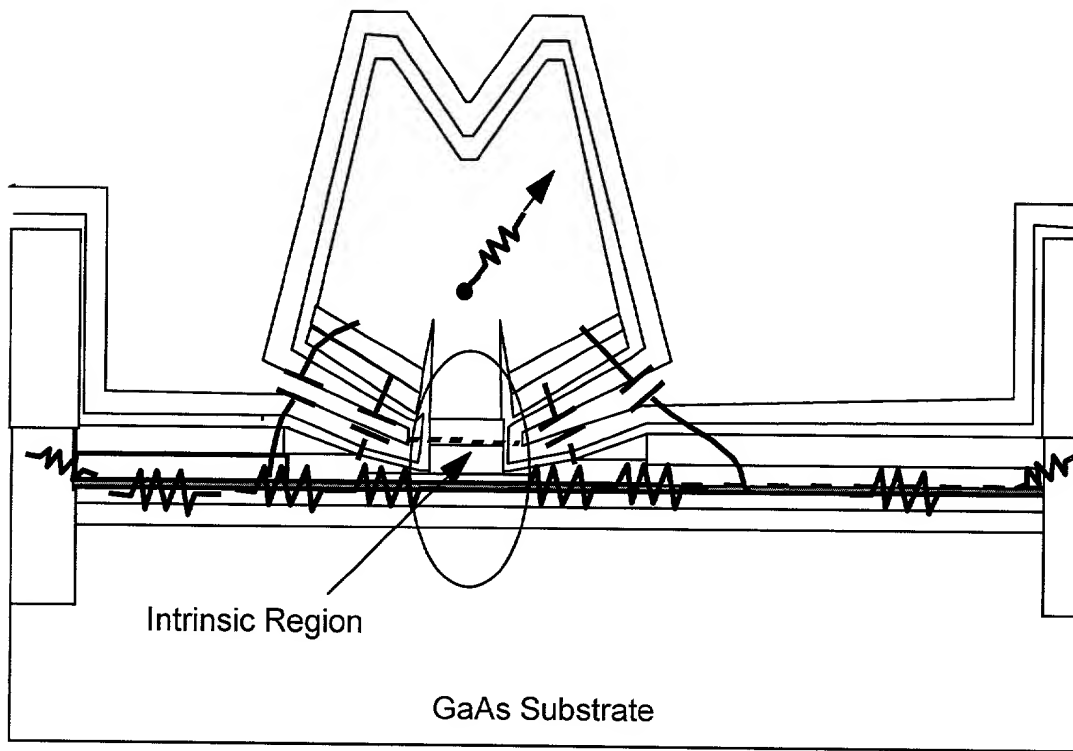


Figure 38

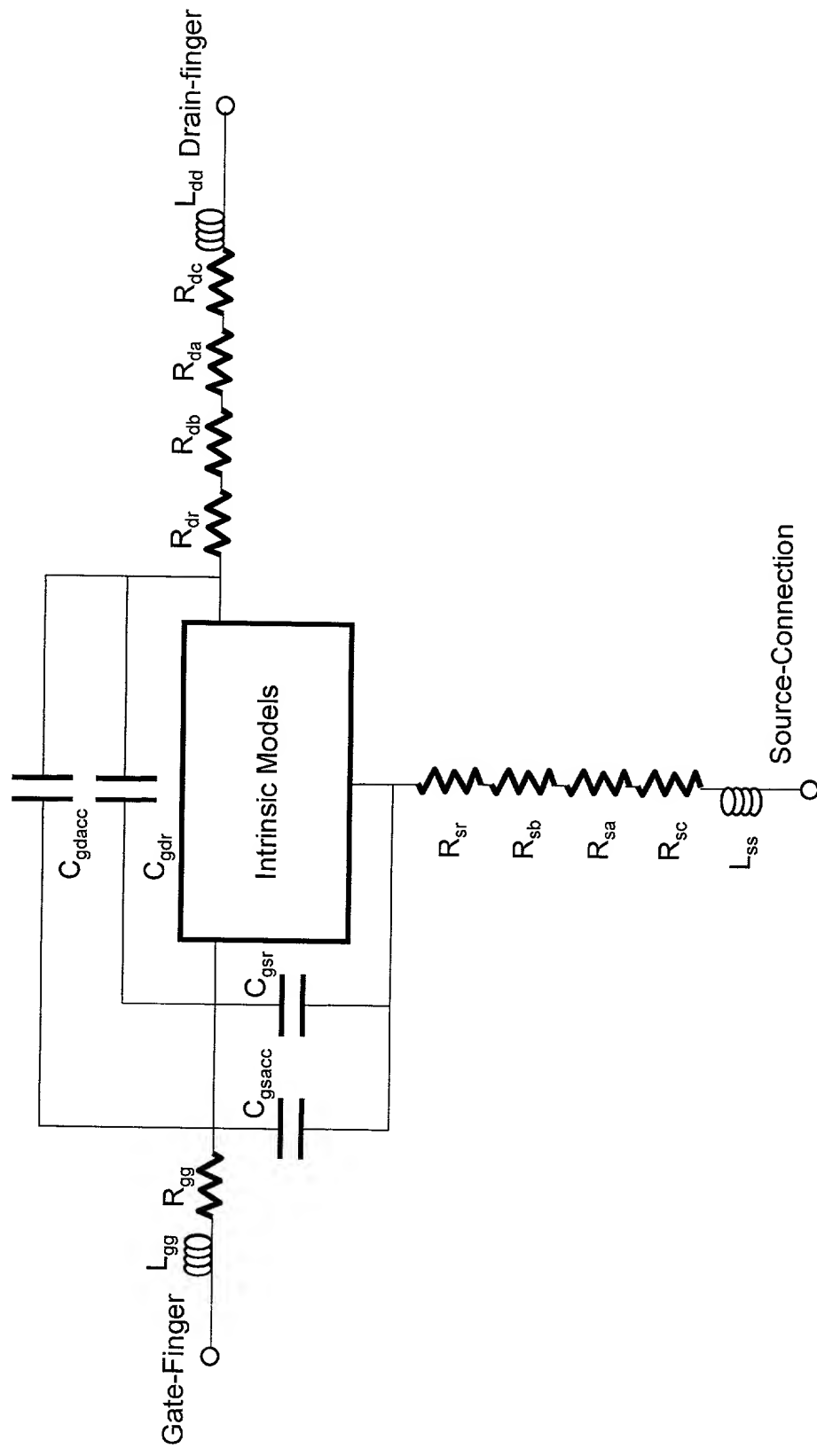


Figure 39

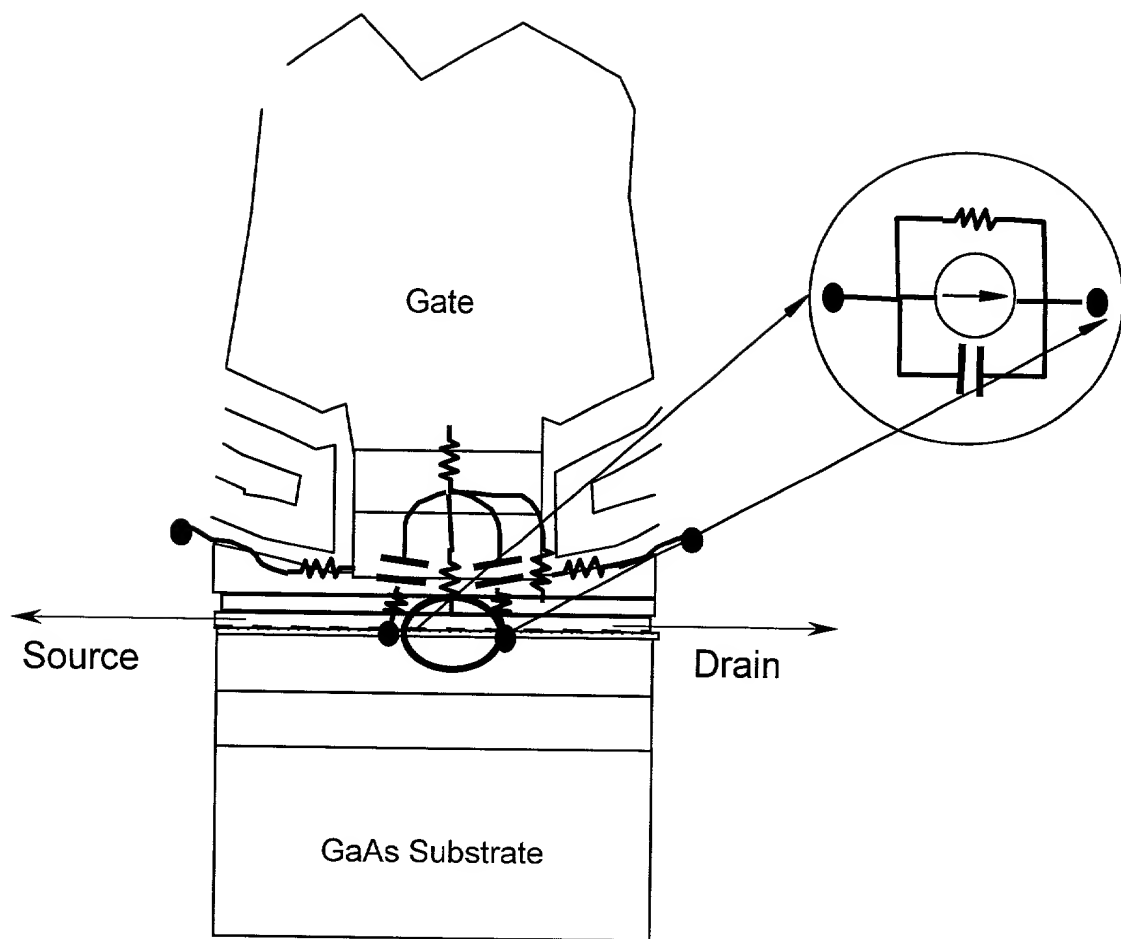


Figure 40

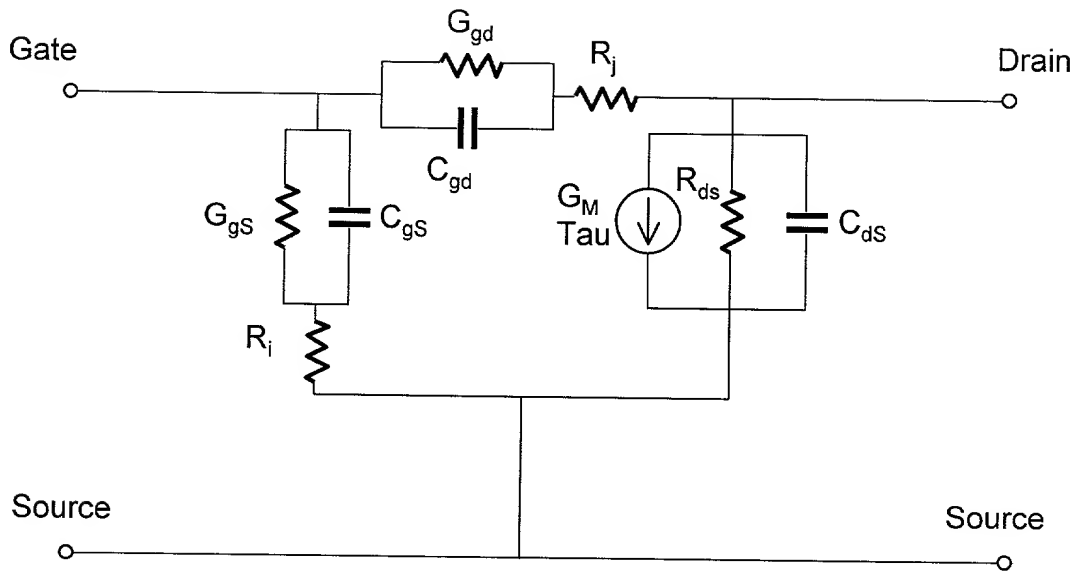


Figure 41

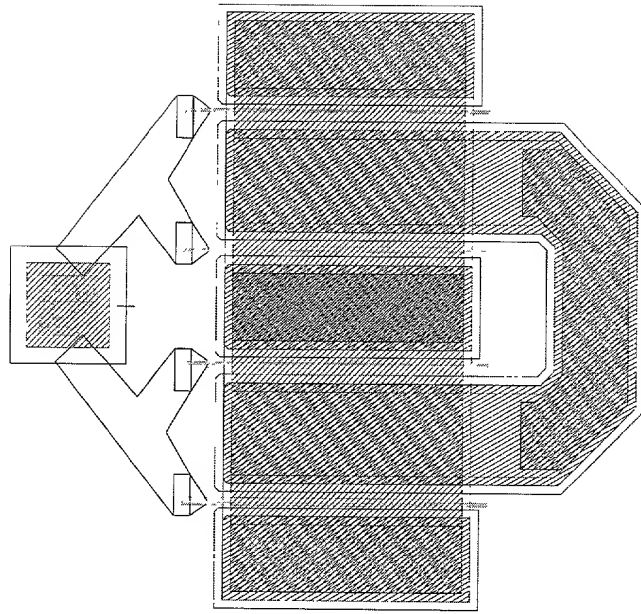


Figure 42A

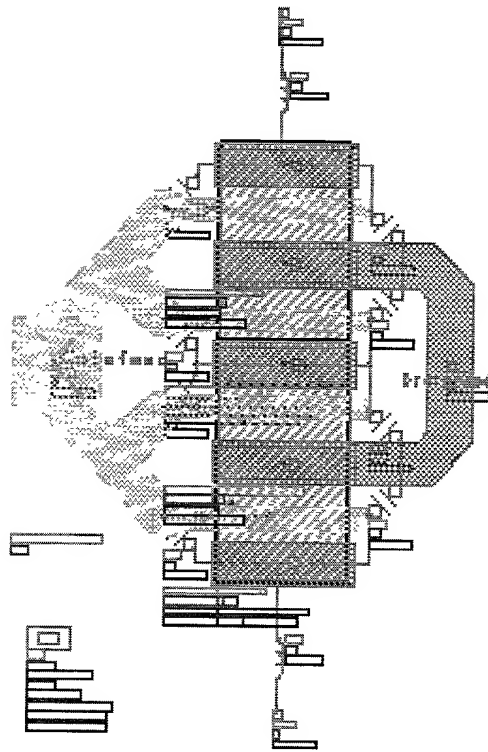


Figure 42B

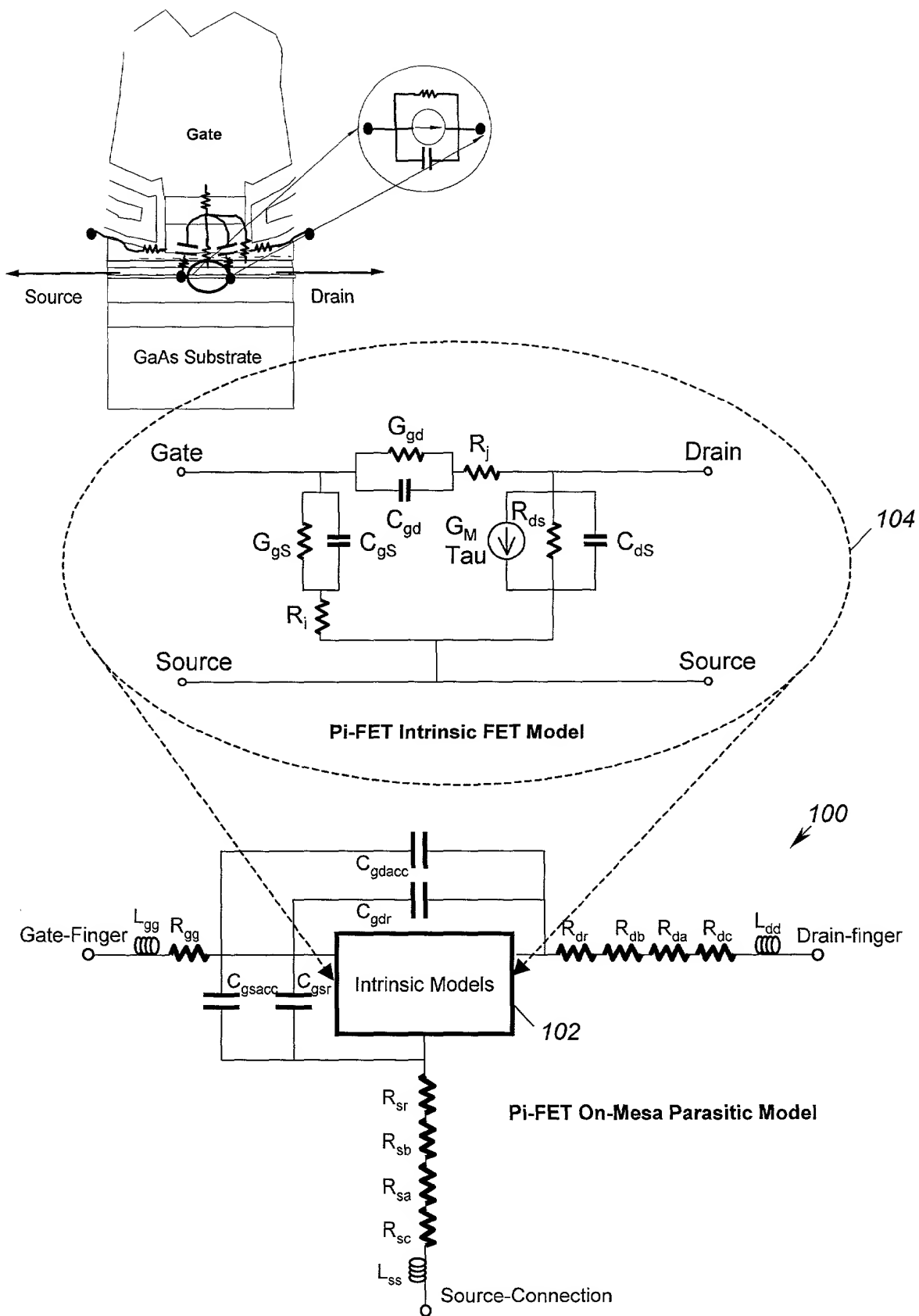


Figure 43

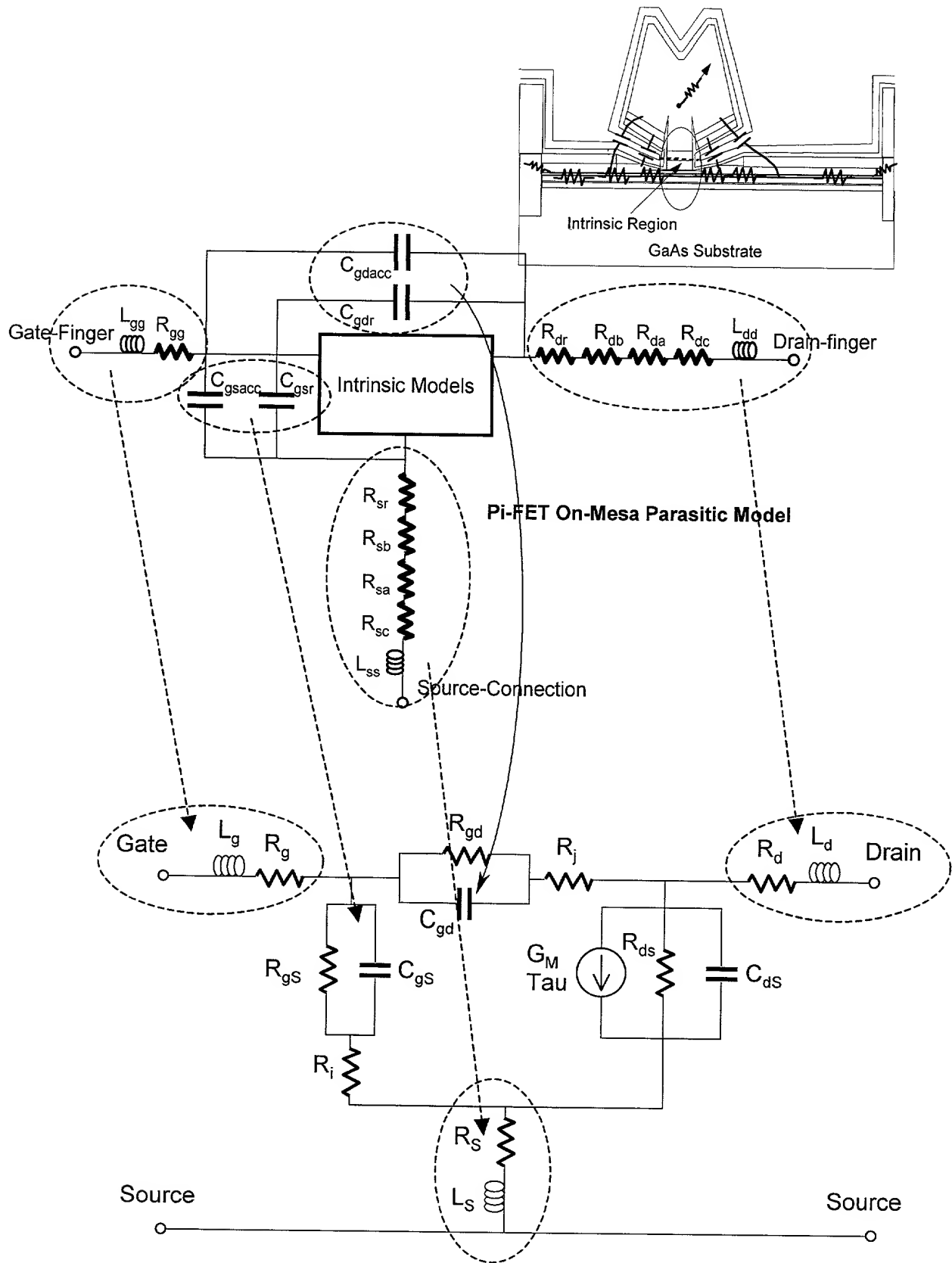


Figure 44



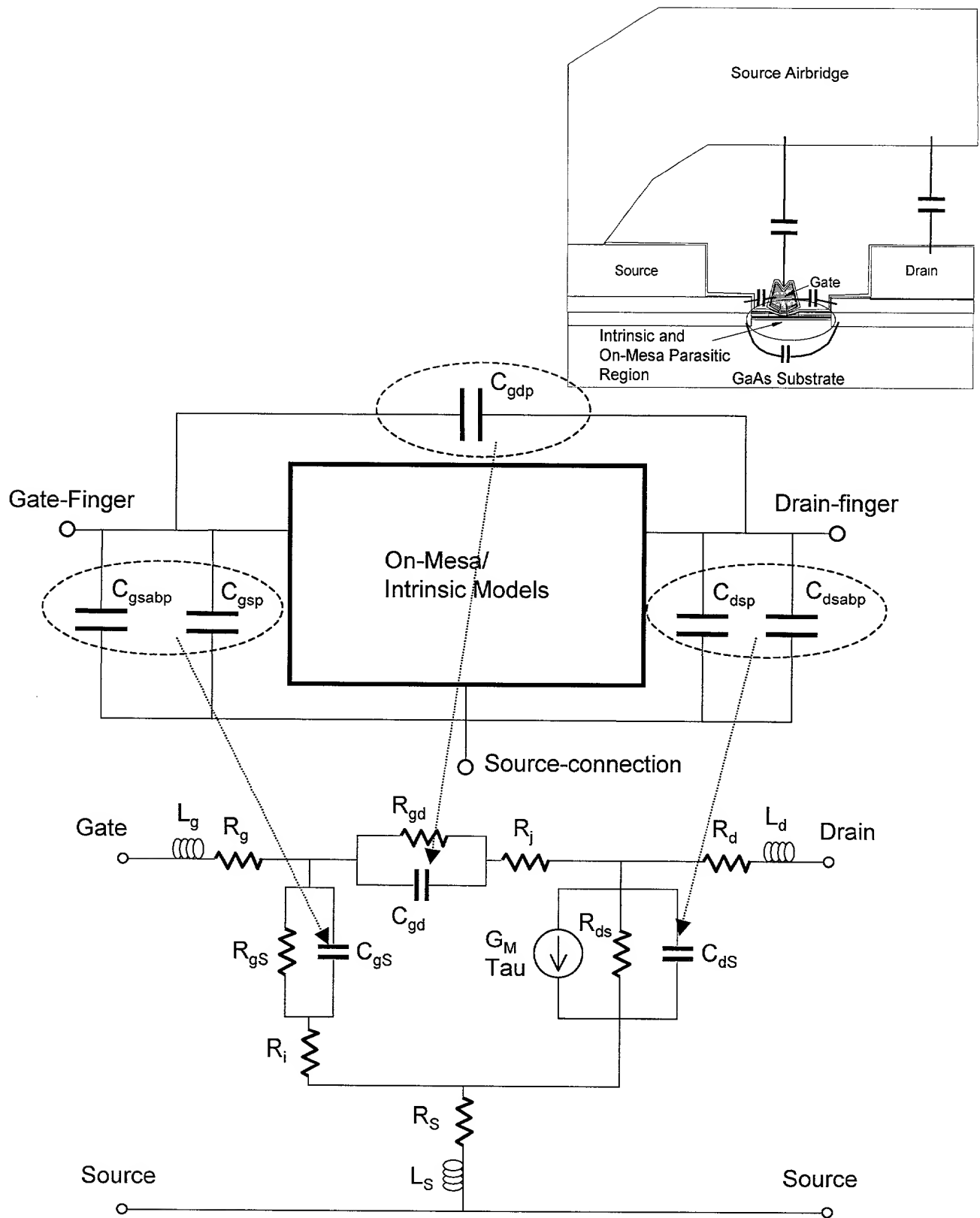


Figure 45

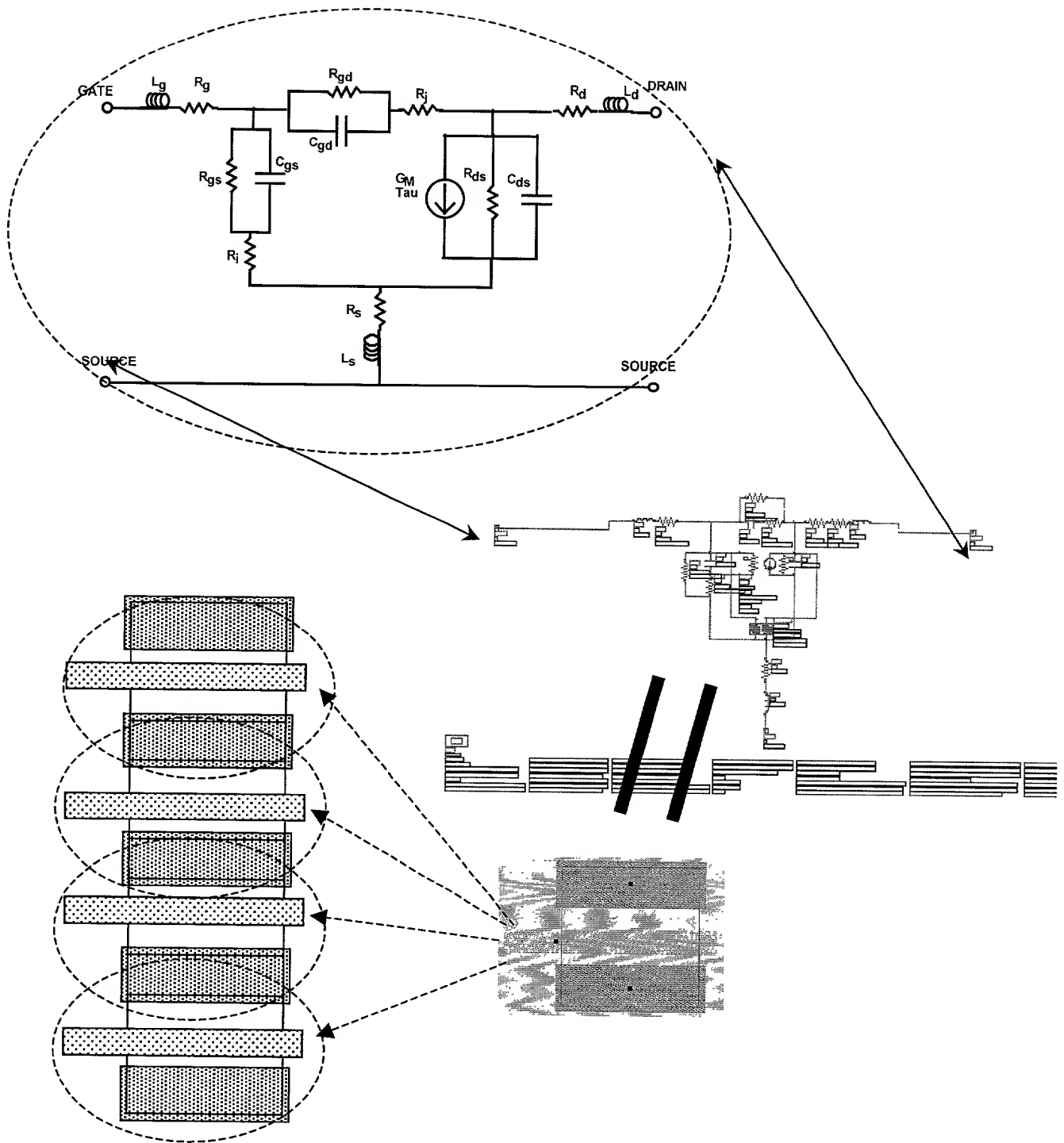


Figure 46

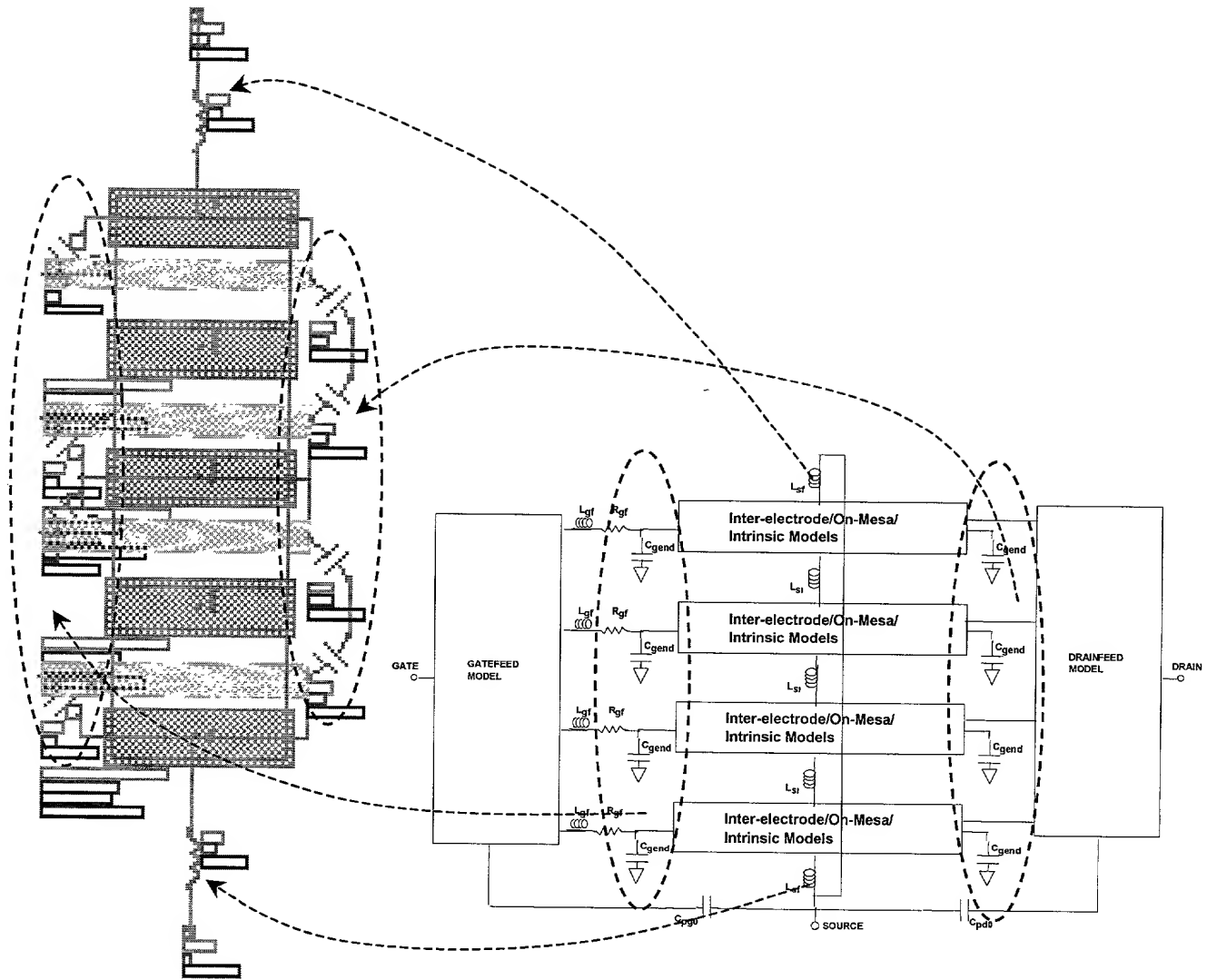


Figure 47

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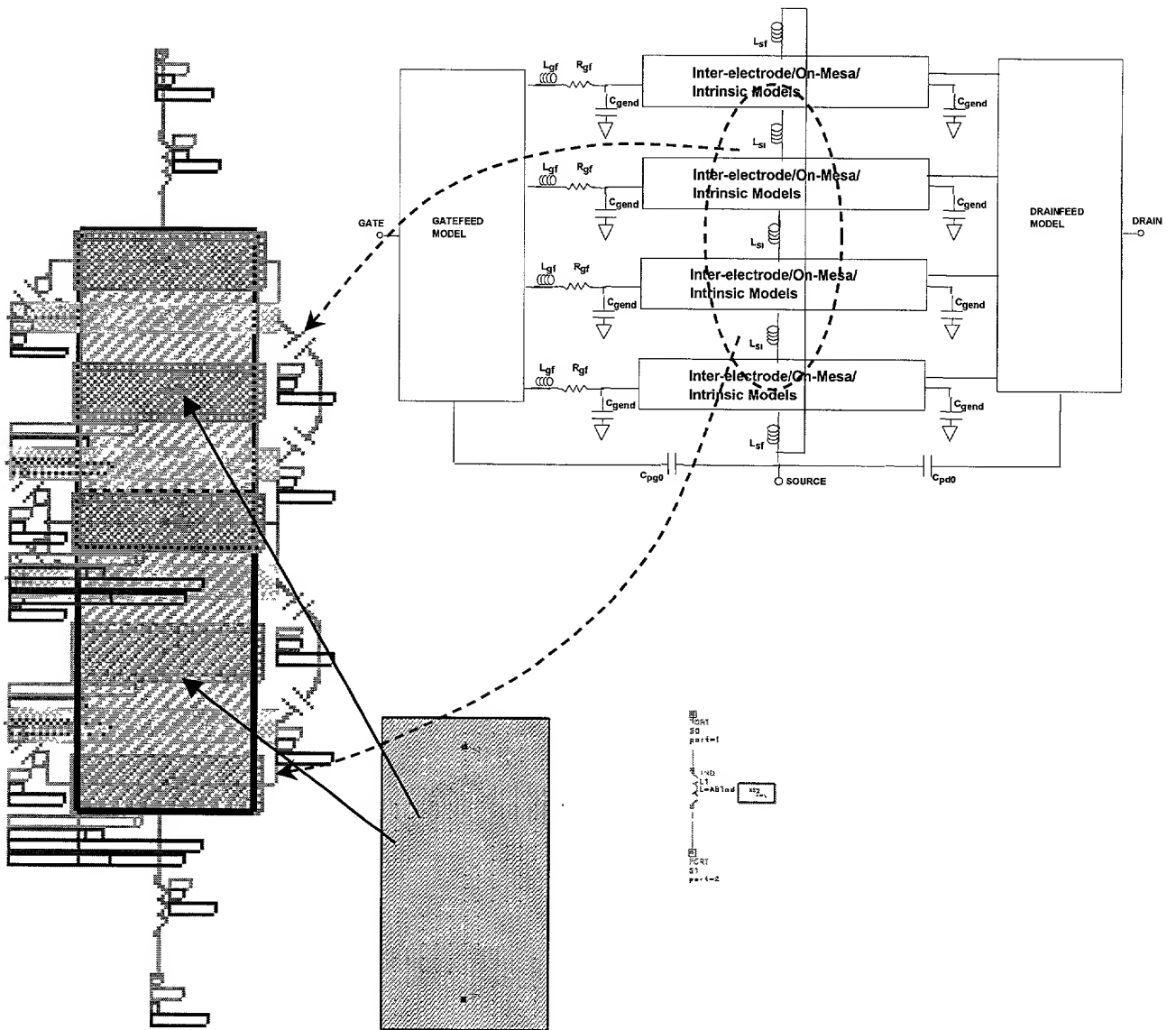
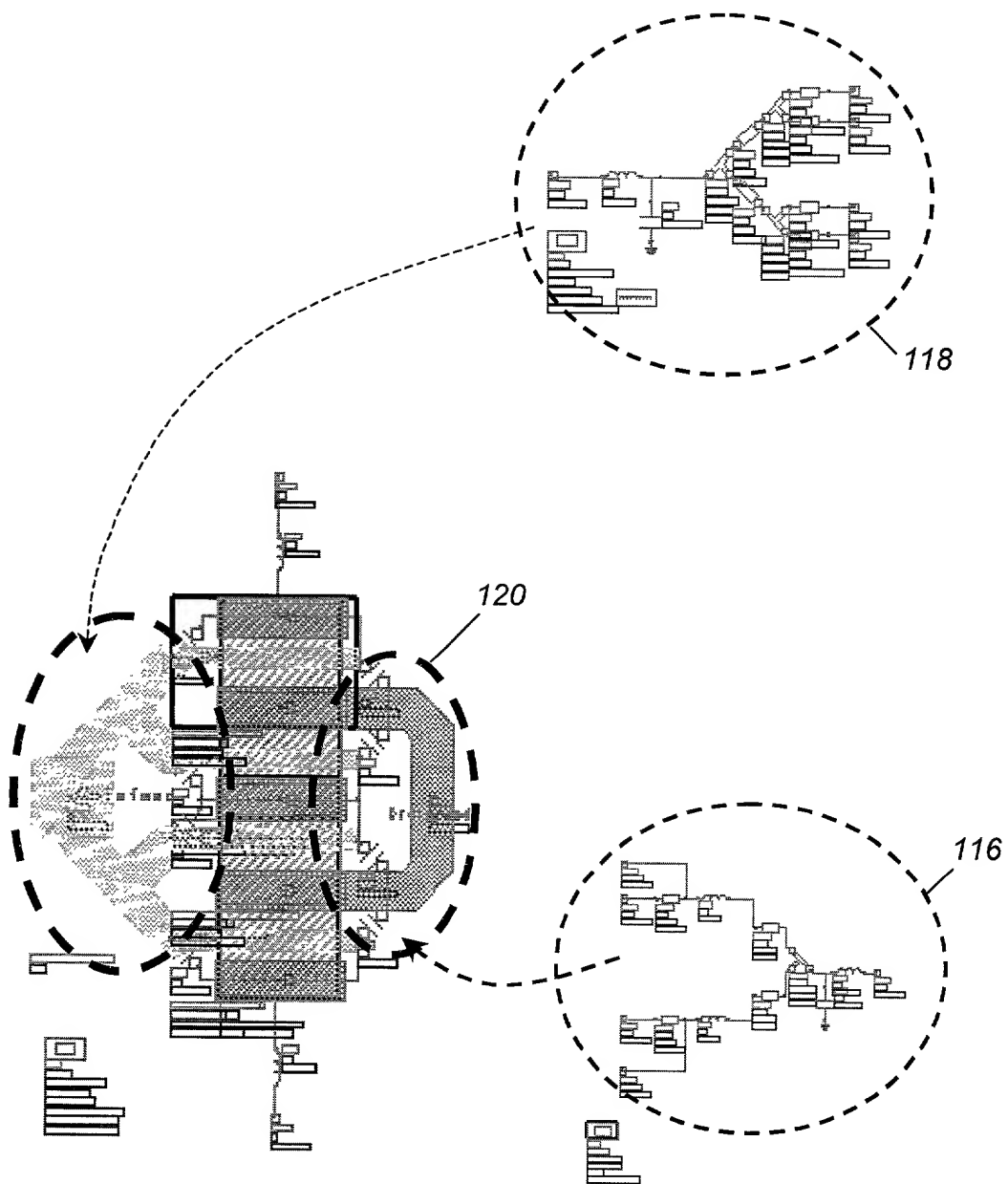


Figure 48



Implementation of the fifth level of embedding

Figure 49



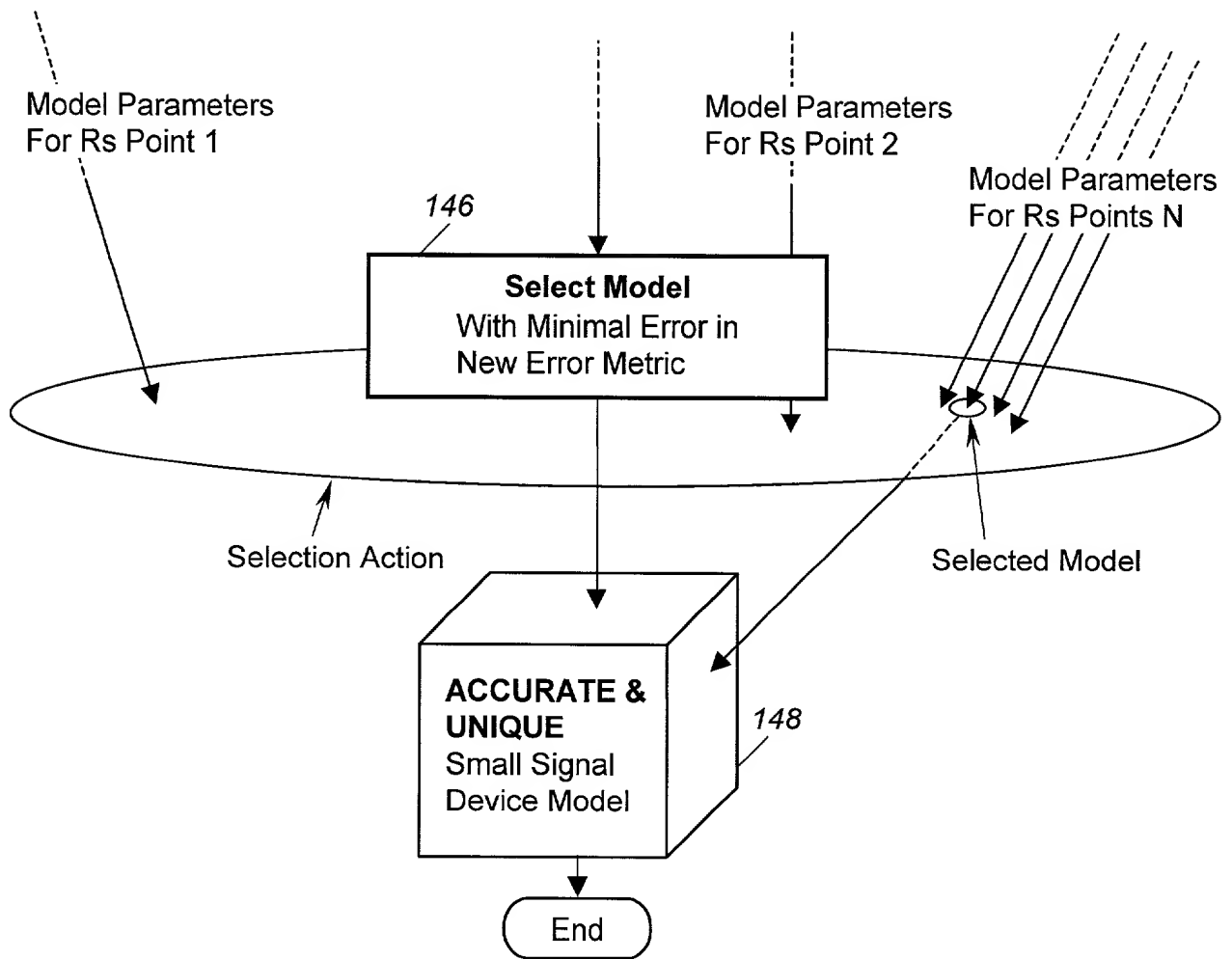


Figure 50B

Final Error vs RS Map for YYY-STATE 1coc\_\_

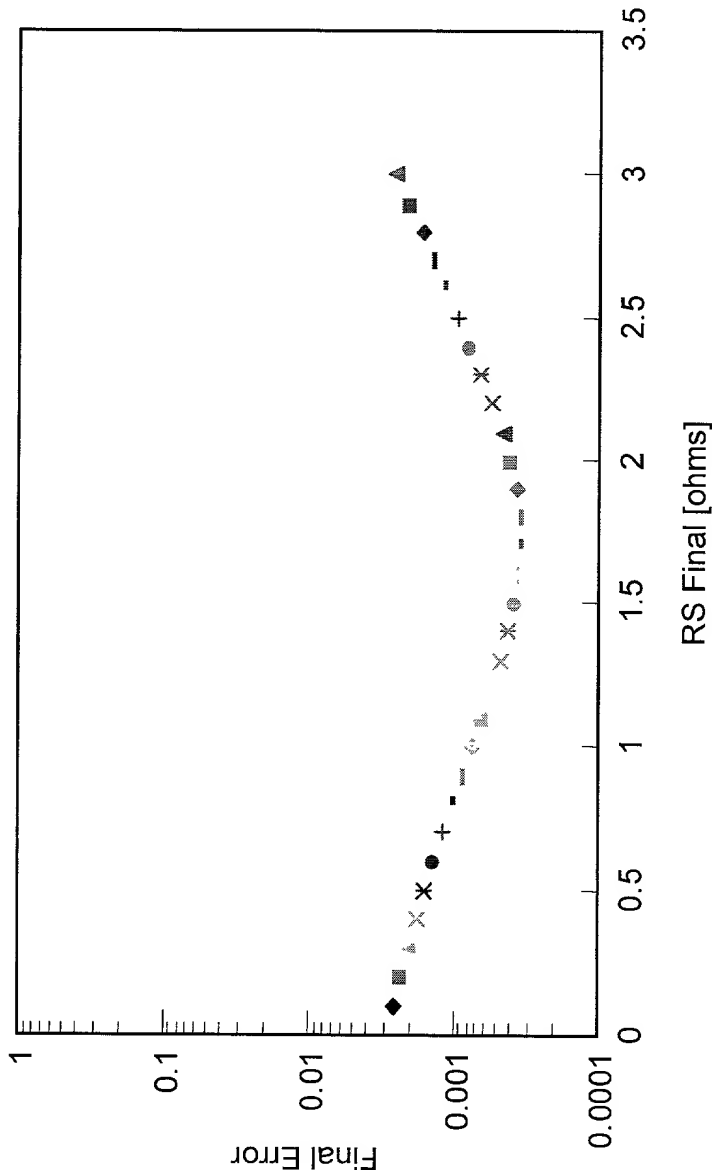
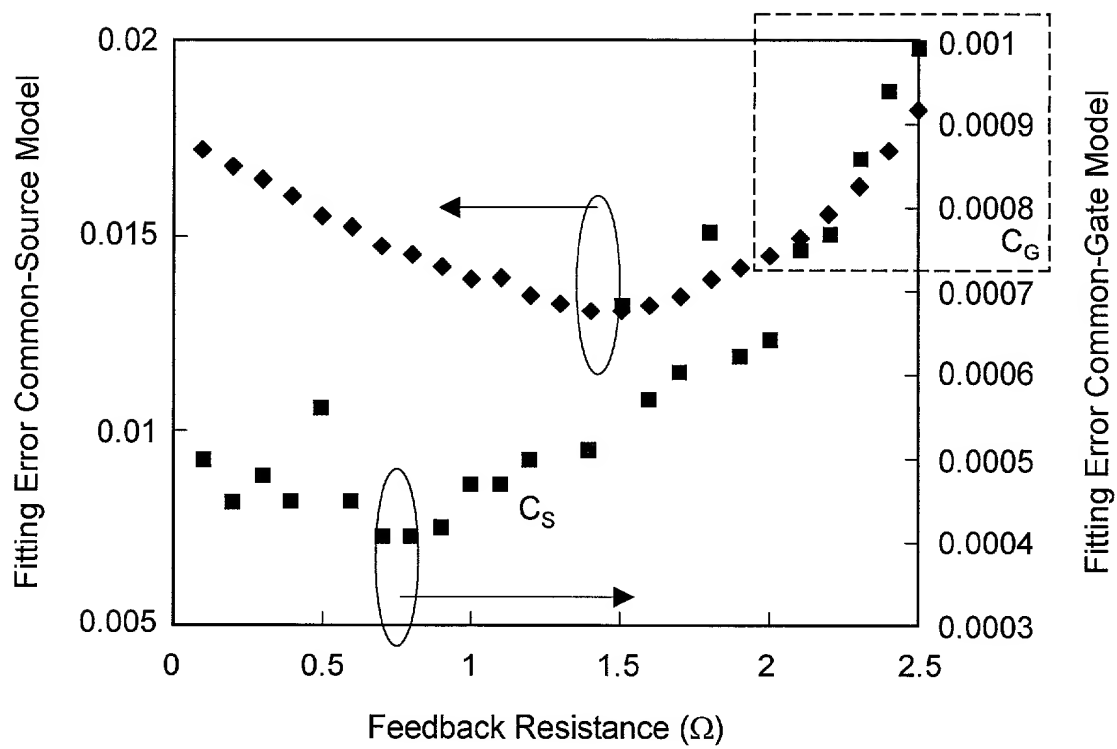


Figure 51

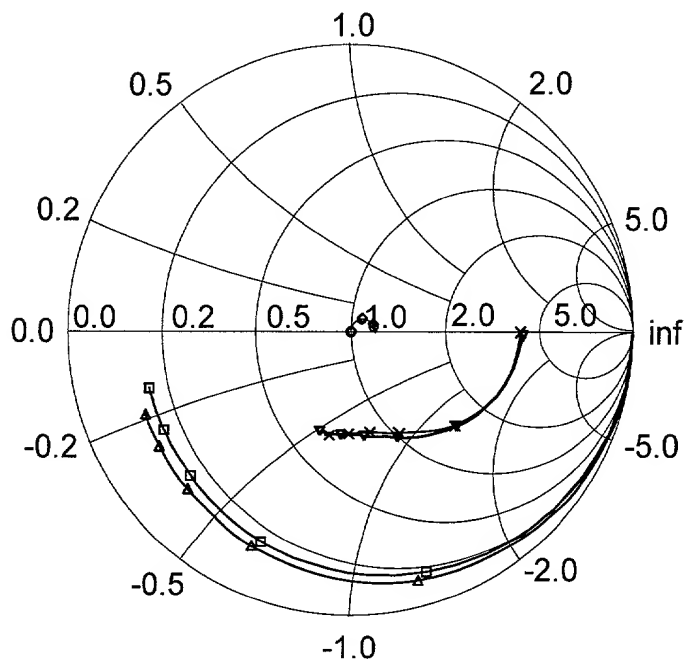
◆ RS=0.1, RD=0.000004, RG=3.631111  
 ■ RS=0.2, RD=0.00006, RG=3.700725  
 ▲ RS=0.3, RD=0.00006, RG=3.827767  
 × RS=0.4, RD=0.000077, RG=3.917606  
 × RS=0.5, RD=0.00002, RG=4.002959  
 \* RS=0.6, RD=0.000063, RG=4.121072  
 + RS=0.7, RD=0.000672, RG=4.225347  
 - RS=0.8, RD=0.00007, RG=4.32573  
 - RS=0.9, RD=0.000001, RG=4.427338  
 ◆ RS=1, RD=0.000284, RG=4.536612  
 ◆ RS=1.1, RD=0.000042, RG=4.627873  
 RS=1.2, RD=0.380034, RG=4.667158  
 × RS=1.3, RD=0.861394, RG=4.69531  
 × RS=1.4, RD=1.568092, RG=4.676249  
 ● RS=1.5, RD=2.072742, RG=4.704008  
 + RS=1.6, RD=2.741666, RG=4.685351  
 - RS=1.7, RD=3.309899, RG=4.711895  
 - RS=1.8, RD=3.901662, RG=4.722658  
 ◆ RS=1.9, RD=4.528121, RG=4.730933  
 ■ RS=2, RD=5.080991, RG=4.75499  
 ▲ RS=2.1, RD=5.649669, RG=4.781182  
 × RS=2.2, RD=6.197713, RG=4.81535  
 × RS=2.3, RD=6.720198, RG=4.855583  
 ● RS=2.4, RD=7.205221, RG=4.909625  
 + RS=2.5, RD=7.705211, RG=4.960891  
 - RS=2.6, RD=8.202621, RG=5.01476  
 - RS=2.7, RD=8.779481, RG=5.030824  
 ◆ RS=2.8, RD=9.386087, RG=5.027081  
 ■ RS=2.9, RD=9.911043, RG=5.074825  
 ▲ RS=3, RD=10.48296, RG=5.083981  
 × RS=0.911268, RD=3.009443, RG=4.152256  
 × RS=1.439659, RD=3.33544, RG=3.769519  
 × RS=1.606168, RD=3.520349, RG=3.502953





**Figure 52**

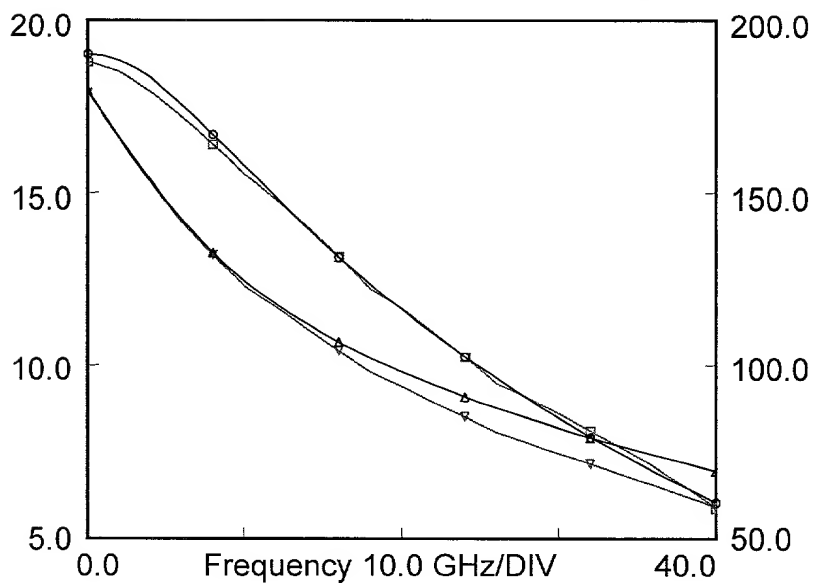
□ measure	○ measure	▽ measure	△ Simulated	◇ Simulated	× Simulated
SMAT1	SMAT1	SMAT1	SMAT1	SMAT1	SMAT1
S[1,1]	S[1,2]	S[2,2]	S[1,1]	S[1,2]	S[2,2]



Frequency 0.05 to 40.05 GHz

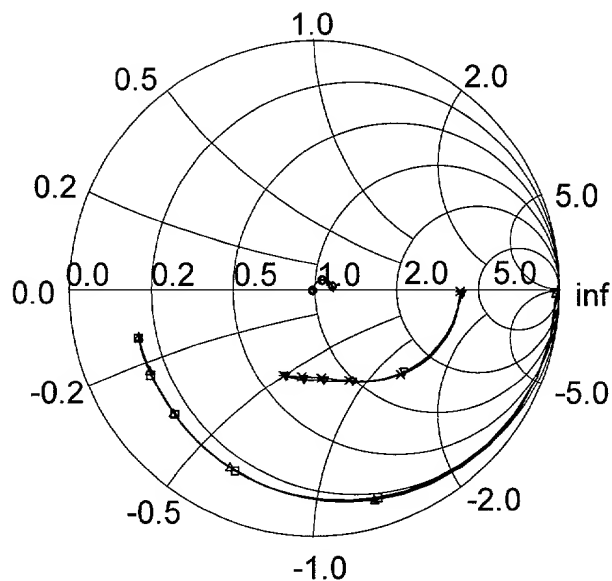
**Figure 53A**

□ measure	○ Simulated	▽ measure	△ Simulated
SMAT1	SMAT1	SMAT1	SMAT1
S[2,1]	S[2,1]	S[2,1]	S[2,1]
dB	db	Ang	Ang
		deg	deg



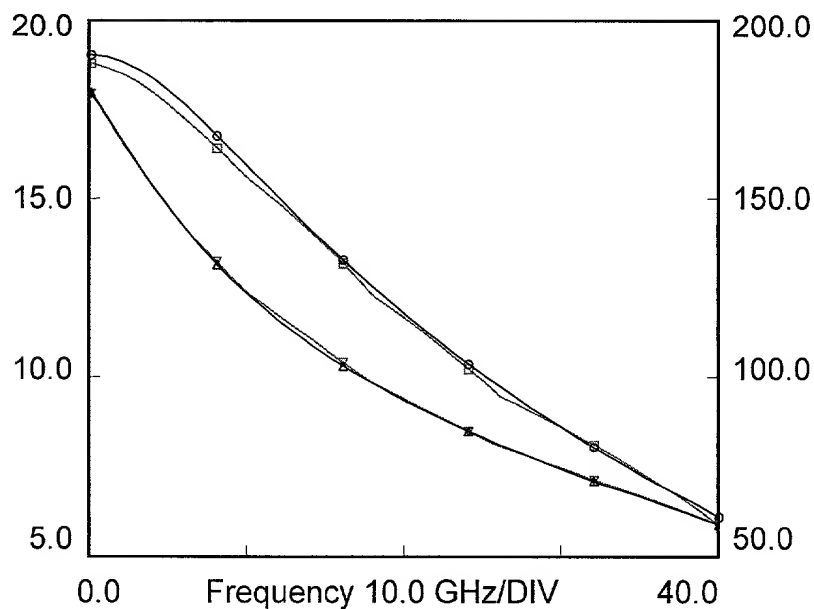
**Figure 53B**

□ measure SMAT1 S[1,1]    ○ measure SMAT1 S[1,2]    ▽ measure SMAT1 S[2,2]    △ Simulated SMAT1 S[1,1]    ◇ Simulated SMAT1 S[1,2]    × Simulated SMAT1 S[2,2]



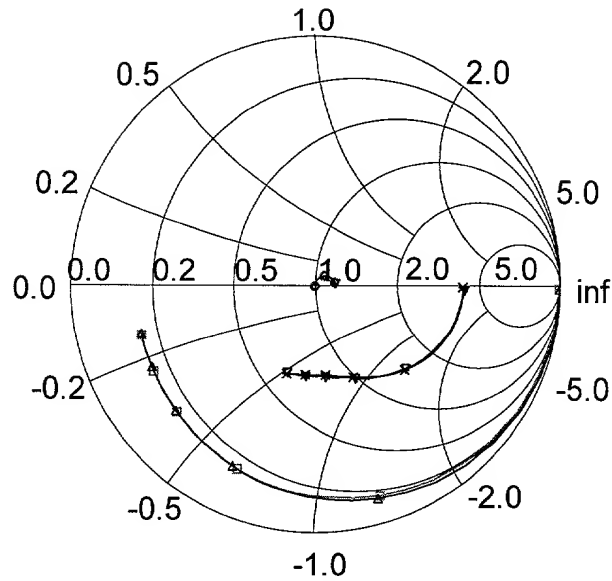
**Figure 54A**

□ measure SMAT1 S[2,1] dB    ○ Simulated SMAT1 S[2,1] db    ▽ measure SMAT1 S[2,1] Ang deg    △ Simulated SMAT1 S[2,1] Ang deg



**Figure 54B**

□ measure	○ measure	▽ measure	△ Simulated	◇ Simulated	× Simulated
SMAT1	SMAT1	SMAT1	SMAT1	SMAT1	SMAT1
S[1,1]	S[1,2]	S[2,2]	S[1,1]	S[1,2]	S[2,2]



Frequency 0.05 to 40.05 GHz

Figure 55A

□ measure	○ Simulated	▽ measure	△ Simulated
SMAT1	SMAT1	SMAT1	SMAT1
S[2,1]	S[2,1]	S[2,1]	S[2,1]
dB	db	Ang	deg

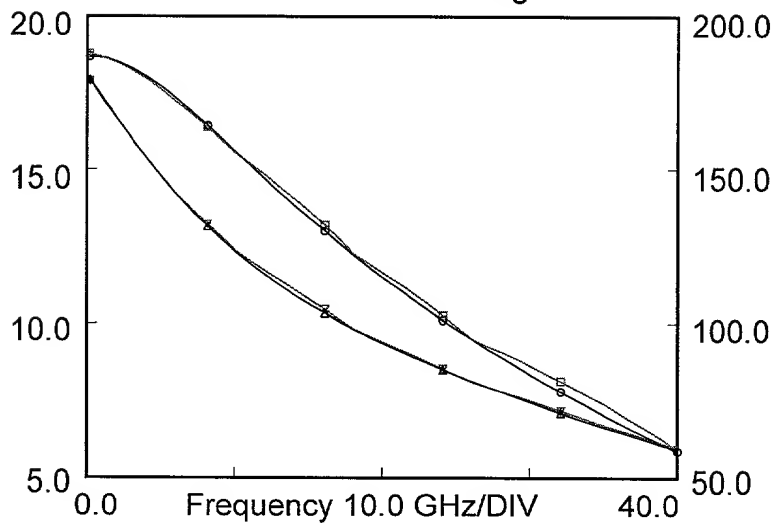


Figure 55B

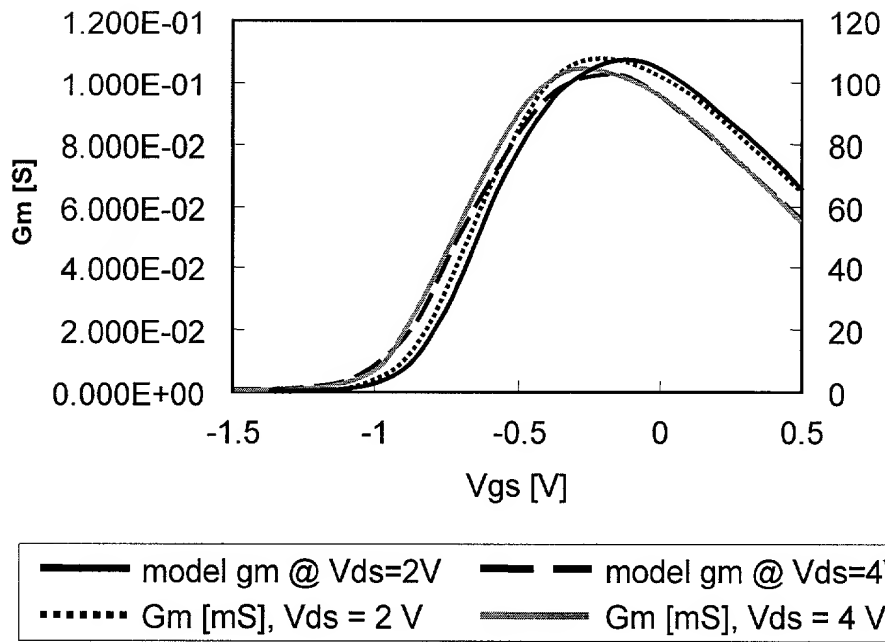


Figure 56

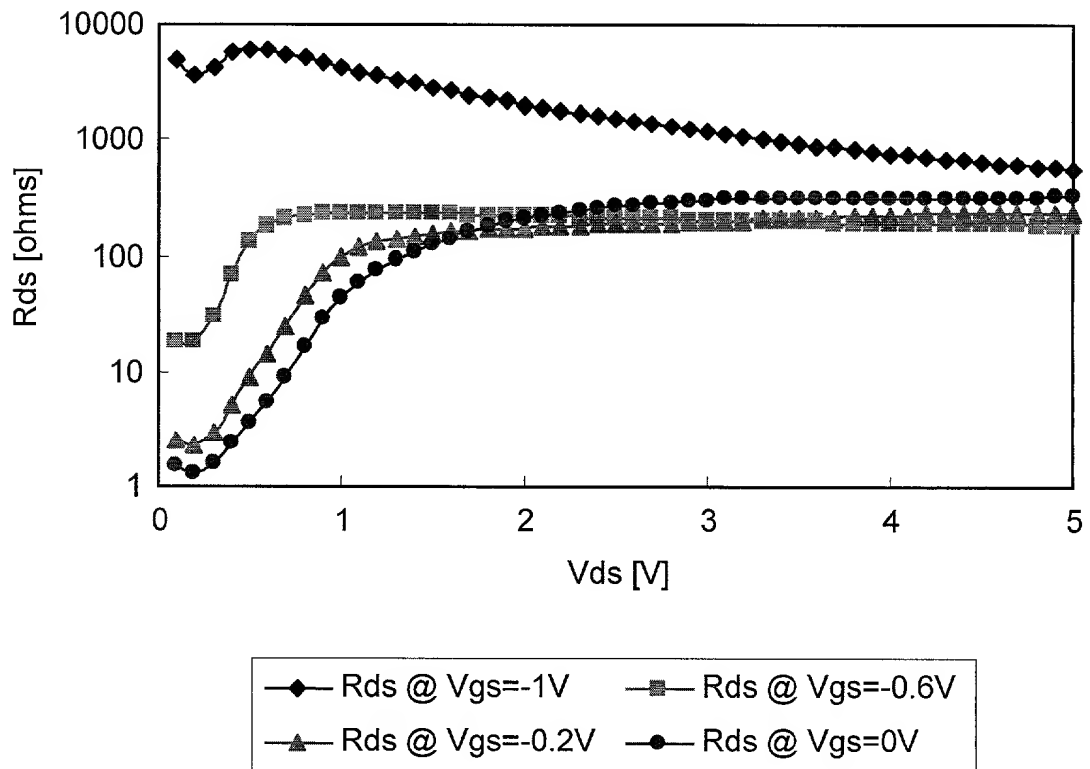
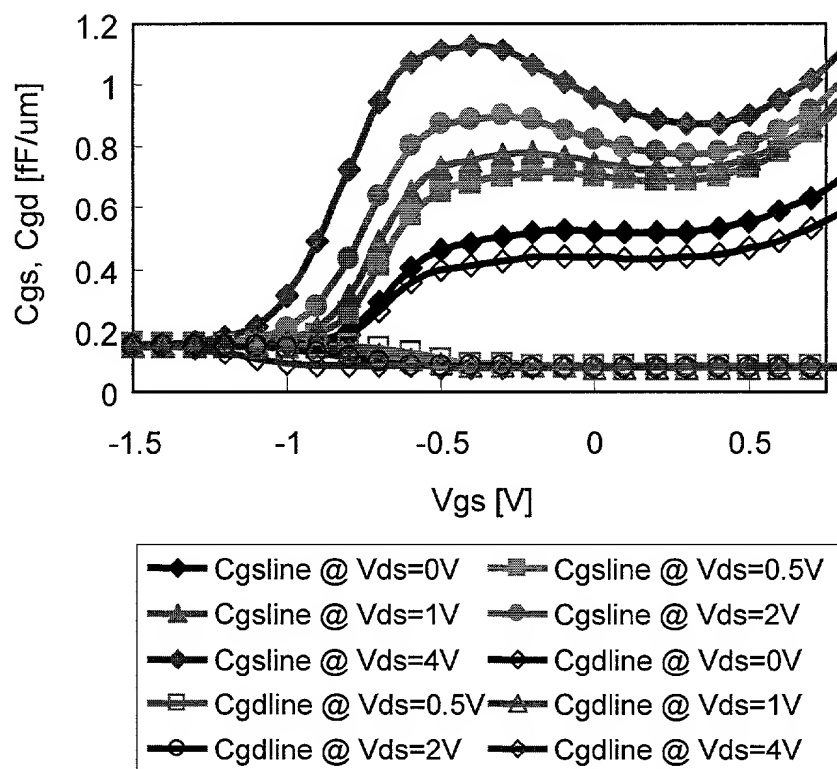
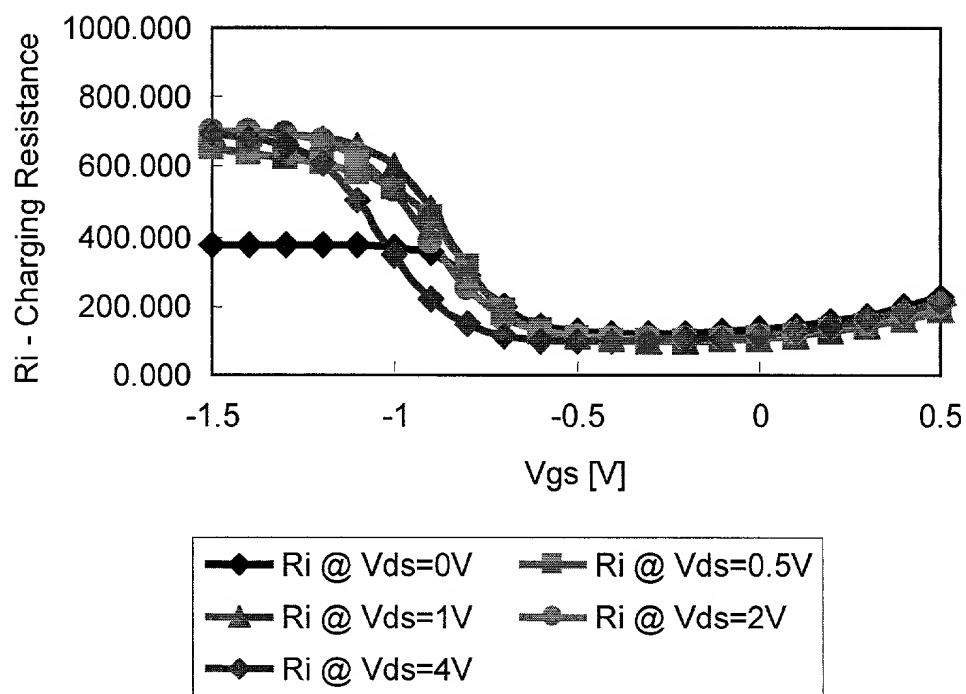


Figure 57



**Figure 58**



**Figure 59**

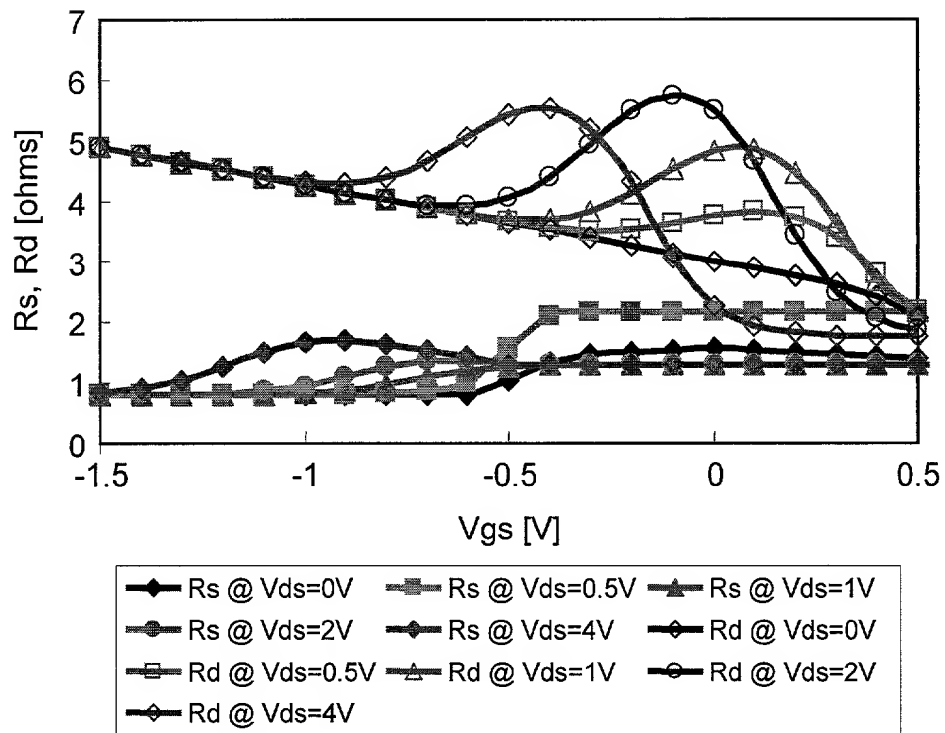


Figure 60

### Measured vs Simulated Bias- Dependent Gain @ 23.5 GHz

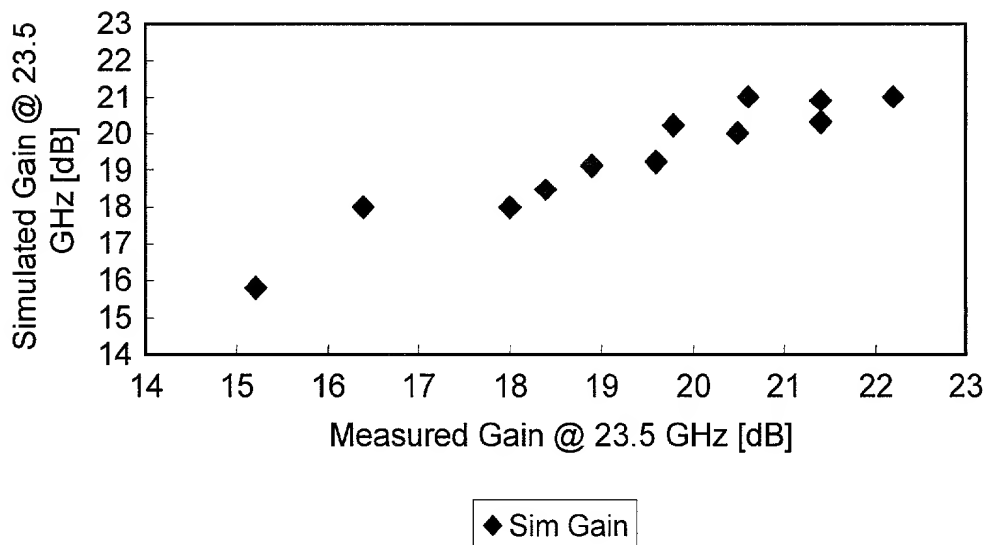


Figure 61

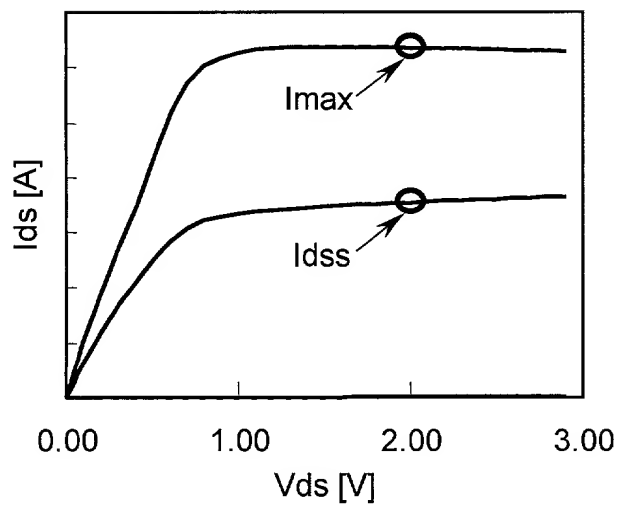


Figure 62A

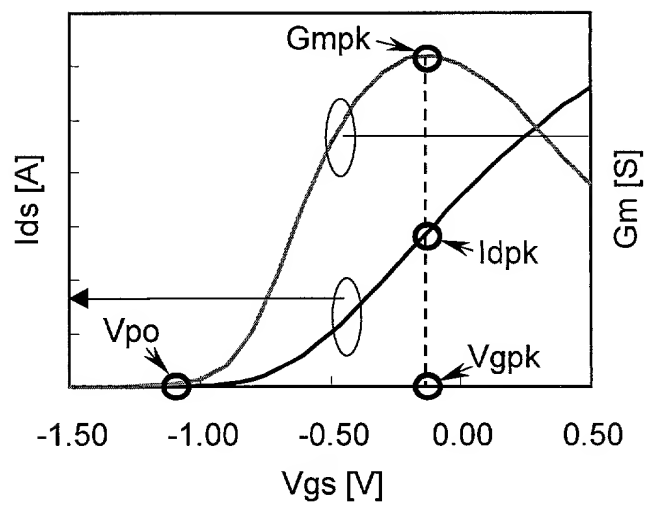


Figure 62B

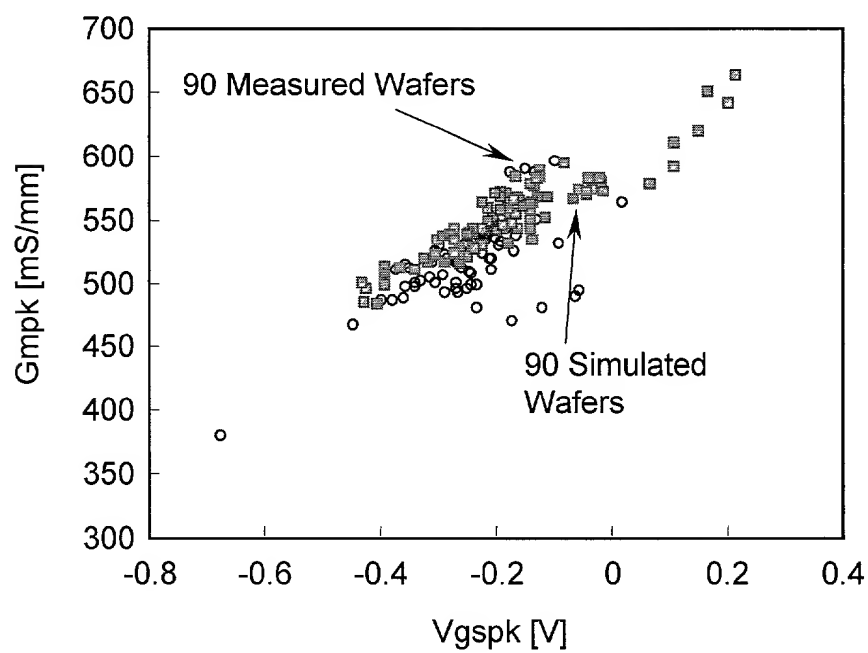


Figure 63



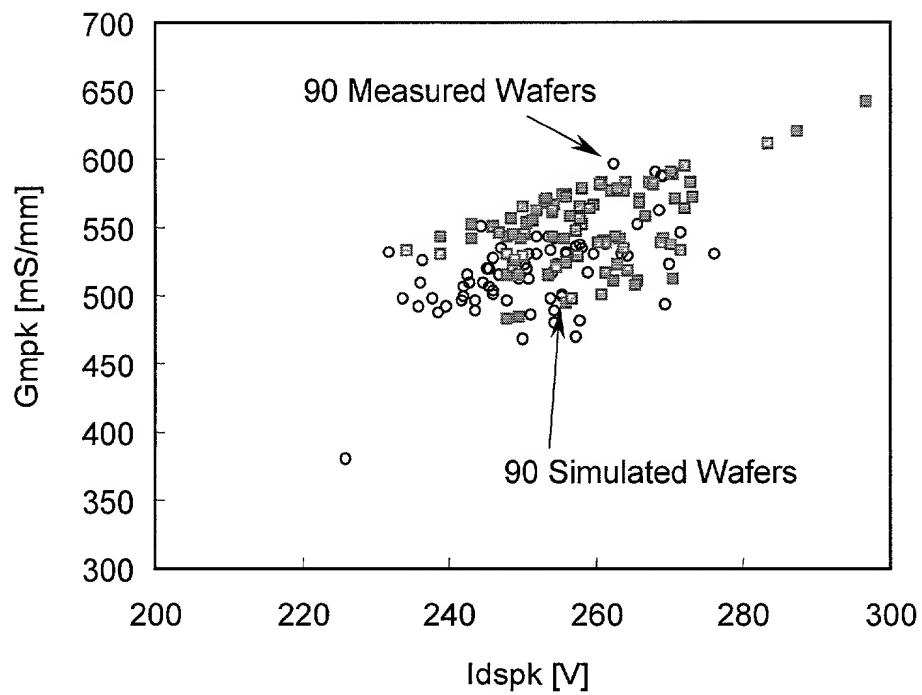


Figure 64

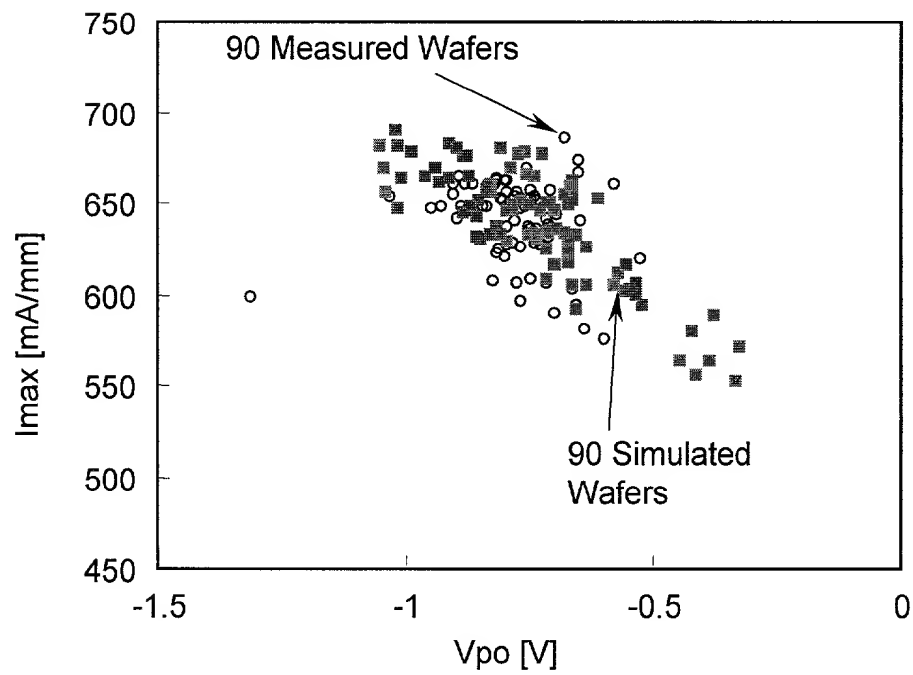
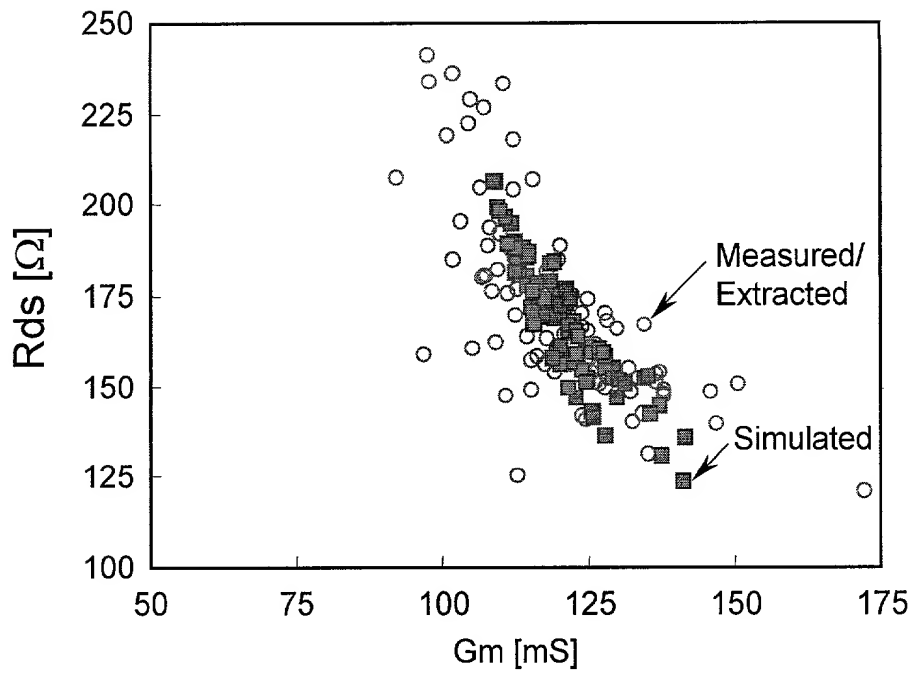
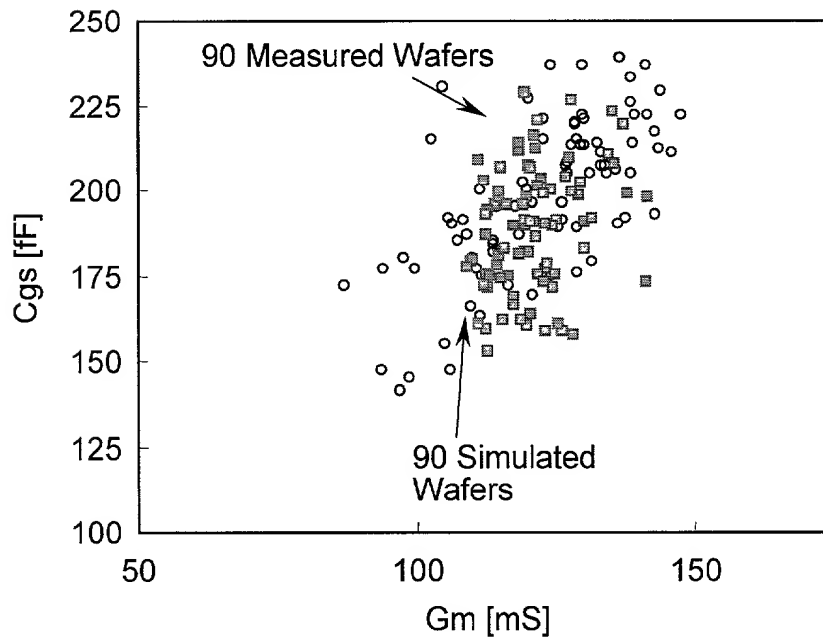


Figure 65



**Figure 66**



**Figure 67**

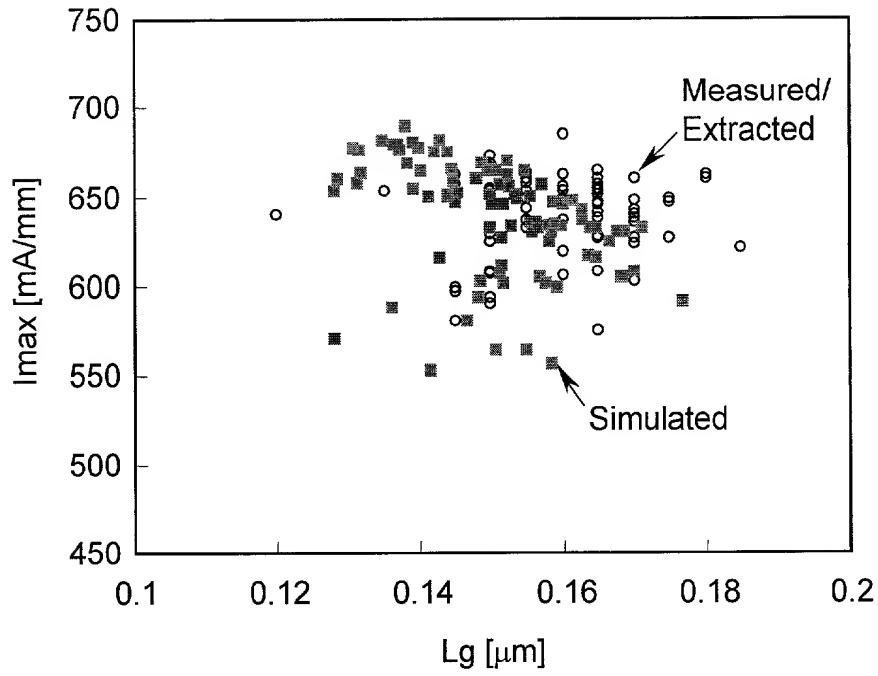


Figure 68

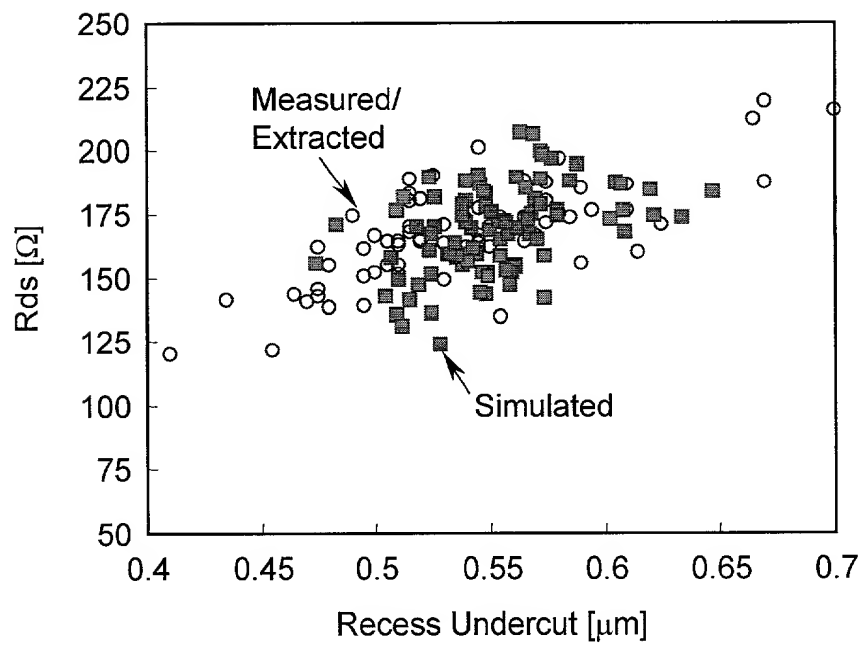


Figure 69